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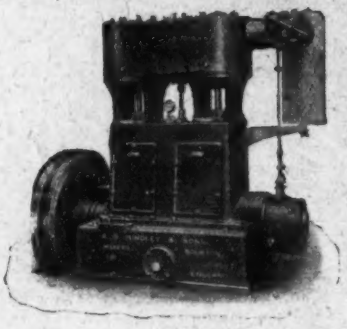

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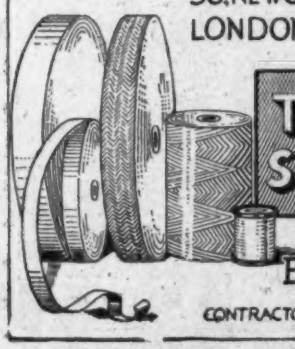

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THE NEW PATENT BILL.

THE Patents and Designs Bill, which was introduced in the House of Commons by Sir Albert Stanley in November last, and which will shortly come under discussion, demands the close attention of all who are interested in the industrial progress of the country, as well as all present or prospective inventors, patentees, and manufacturers whose personal interests are affected by its provisions. It is designed to remove the defects of the Act of 1907, which have been revealed by the experience of its working, as well as those of the Temporary Rules put into force in 1914 to meet the conditions of war-time, and to introduce much-needed reforms into our patent system. While it is impossible in the space at our disposal to discuss its provisions in detail, there are certain points to which we wish to draw the attention of our readers.

We have pointed out on previous occasions that the prime object of granting a monopoly to the inventor of a new process or device is not to secure for him the opportunity of acquiring profits, but to induce him to publish his invention, and ultimately to place it at the disposal of the public, with a view to advancing the industrial prosperity of the nation as a whole. A secondary object, however, is to reward the inventor for his labour, and to encourage him to exercise his brain in further inventive effort, by affording him protection against the unscrupulous who would exploit his genius for their own advantage, and enabling him to obtain the support of capital; and a third aim is to attract new industries to this country with a view to their establishment amongst us—the last, in fact, being the original motive of the grant of letters patent for inventions under the Statute of Monopolies in 1623. Three centuries ago we led the world in this respect, although we had not then become a great industrial nation; it cannot, unfortunately, be said that we have retained our lead, and, while the new Bill goes some way towards regaining the lost ground, it appears to us to fall short of the desired end in several respects.

Hitherto the principal object of the Patent Acts seems to have been to provide a comfortable income for the lawyers, and that of the Patent Office to secure as large a net revenue as possible for the National Exchequer, neither of which aims can be commended as being in the best interests of the nation, while the true purpose of the institution has received but scant attention from Parliament. The legal procedure involved in the defence of patents against infringement has been costly and protracted in the extreme, rendering it impossible for any but the well-to-do to maintain a patent against the attacks of powerful rivals, and culminating in an appeal to a tribunal—the House of Lords—which merely reviews the recorded evidence, hears legal arguments, and not rarely pronounces judgments on this meagre basis which not only contradict the Courts below, but also appear to be contrary to justice and equity—sometimes by a bare majority in a small House. So long as the House of Lords remains the Supreme Court of the United Kingdom, no doubt this state of things cannot be remedied; but, at least, all possible efforts should be made to simplify and shorten the procedure, to enlarge the powers of the Comptroller, and to re-

duce the number and variety of the legal devices by which the process is encumbered and the ends of justice too often are defeated.

While the public welfare is the fundamental consideration, and the inventor's reward a secondary matter, it must not be forgotten that the encouragement of the inventor incidentally promotes the former aim; this fact has been admirably exemplified in the establishment by the Government of special departments for the investigation of inventions for the purpose of prosecuting the war, and though hardly one proposal in 10,000 may prove fruitful, it is well worth while to wade through the 9,999 in order to secure that one idea. Precisely the same reasoning applies to peace conditions, but before the war it never entered the heads of our rulers that they should appeal to the inventor to come forward with new ideas. On the contrary, many obstacles were thrust in his path; he was called upon not only to pay a fee on application for letters patent, but also to pay heavy fees for their maintenance, under penalty of total loss of the patent, and, in addition, to pay taxes on his income. We agree that an application fee is necessary to prevent the flooding of the Patent Office with worthless ideas, but on what grounds can the exaction of the heavy renewal fees, amounting in the course of the life of the patent to £95, be justified? In this respect we much prefer the procedure of the United States, which grants a patent (and carries out an extensive search into priority) for a single payment of £7. In order, however, to secure the extinction of patents which are worthless in themselves, but nevertheless hinder progress, we suggest that a payment of, say, a further £5 at the end of the fifth and the tenth year respectively might very well be imposed. Again, the life of a British patent is restricted to 14 years; the new Bill proposes to extend this period to 15 or 16 years, but we submit that a still longer period is called for by modern conditions.

The majority of useful inventions nowadays take several years to perfect and to introduce into general use, and the 10 years or so which represent the *useful* life of the patent are much too short to provide an adequate reward to the inventor or manufacturer. In the United States the period is 17 years, and in Canada it is 18; we suggest that the latter figure should be adopted, not only in this country, but throughout the Empire, and that, while there are valid objections to establishing a single Empire patent, the regulations, procedure, and fees should be made identical for each of its components, the whole of the Crown Colonies, however, being covered by a single British patent.

In order to prevent the use of patents by aliens to establish monopolies for their imported manufactures, the Act of 1907 provided for the revocation of a patent if it were not adequately worked in this country; the method of attaining this object, however, proved defective—obviously, the revocation of a patent removes all incentive to a British manufacturer to make use of the device—and the new Bill provides other and more effective means of attaining the desired end, which we hope will be found satisfactory.

Overseas Trade of the Future.

The speech of Sir Arthur Steel-Maitland on the Vote for Salaries, &c., of the Overseas Trade Department did not contain much information that would be new to our readers, as we have already been permitted to describe the plan of operation of the Department in these pages. But only good can result from such a statement to members of the House of Commons and to the nation as a whole. The same remark applies to the discussion which followed the speech, in which different members referred to the well-worn subject of the past deficiencies of our Consular Service. Sir Arthur does not seem to agree altogether with the usual criticisms, and he repeats his statement that we and competing industrial peoples all seem to think that the other has the best service. He considers that the duties that a Consul can perform to the commercial community are sometimes over-estimated. "Sometimes" they may be, but the solid fact remains that there has been practical unanimity in the business world on the question for many years. We have welcomed the new scheme under which Trade Commissioners and Commercial Attachés will be "watching out" zealously in many parts of the world under the new scheme, but in the many places which cannot be favoured with such officials there should be great opportunities for Consuls to show more regard for British trade interests than has been the practice in the past. Sir Arthur does not lose sight of this circumstance. He considers that a consul should possess a really good working knowledge of the trade of the place in which he is stationed, and of the principal traders, so that British business-seekers may be able to obtain from him a general idea of the commercial "lie of the land." When the new system comes into force the more promising Consuls will be eligible as Commercial Attachés after passing work of the Commercial Attachés to collect information from consular districts, to give a good economical survey of the country as a whole, and to inspect the work of the Consuls, seeing that they are doing their duty. This is the proposal in its broadest outline, but the whole of the consular scheme is under consideration with a view to making it adequate to meet after-the-war requirements.

The success of the efforts of the Overseas Trade Department, as has been pointed out before, depends upon the spirit of goodwill and co-operation which may exist between the Board of Trade and the Foreign Office, but it is also dependent upon the measure of confidence with which the scheme is regarded by the business community. If our traders make a frequent and persistent practice of using the service in their efforts to develop commerce, they will do much to assist both Commercial Attachés and Consuls to attain to and maintain a high standard of efficiency. That practice will go far to impress them with the importance of the assistance which they can render to British industries, and they will feel compelled to live up to their position. Want of confidence and want of appreciation have made travellers contemptuously ignore British facilities too often in the past, seeking assistance instead, and at greater pains, in unthinkable offices in the same districts.

It is satisfactory to know that all of the Department's representatives will in future be on the watch for enemy efforts at penetration, yet we cannot forget that some of them have not been unmindful of this tendency in days gone by. Many a consular report and other public document abstracted in our pages in pre-war days told a good deal about what was going on, but of what use was it to know that these things were happening if there was nobody to take appropriate measures to counteract them? We trust that the awakened interest of the legislature in trade affairs, and the existence of trade associations, will provide means for remedying this shortcoming in the future. We were too content in those days, as Sir Arthur recognises, to allow the questions relating to the development of our foreign trade and that of our commercial rivals to go unanalysed, and competition to go without being properly met. The new department, through its various officers, will see to it that movements are watched for and reported upon; but there presumably the work of the department will end, and industry or some other department of the State will have to act.

LEAVES FROM AN ENGINEER'S LOG.

I.—The Volunteer Munition Workers.

By "WHISTLEFIELD."

Our troubles began when the Ministry of Munitions appealed for volunteer munition workers. The fitters, drivers, and other skilled and semi-skilled men about the works thought this was a first-class opportunity to put the screw on the Chief for an increase of pay, and use their new-found patriotism as the lever; but the Chief wasn't born yesterday. He listened patiently and sympathetically to the deputation, drew them on when they worked the patriotic vein, and got each man tied down to the statement that he could do a lot more than he was doing each week, and that he would like to put in the extra time on munitions to help the country. They had expected the Chief to point out that they couldn't be spared from the station, and then they meant to put in strongly for an all-round increase. The Chief warmly commended them for their patriotism, and said he would see what could be done to put them all on munitions. This was hardly what they had expected, and the deputation retired rather crestfallen, but it was nothing to their chagrin when he announced a few days later that he had taken on a contract for the manufacture of 18-pounder high explosive shell, and would install sufficient machines in our workshops to enable each man to put in three evenings a week on shell, in addition to any time he could be spared during ordinary working hours.

He stated, further, that he would modify the usual conditions upon which they were appointed, namely, that their wages were to cover all the ordinary overtime required, and would pay them for all extra time spent on shell at a nominal rate, till they had gained sufficient experience to make the job pay.

There was a good deal of heart-burning among the skilled men who had formed the deputation, especially at the "nominal rate," but they had to admit that the Chief had scored again, and they were too far committed by their own words to draw back.

Sandy McNab, the mechanical superintendent, however, was a happy man from that day. The Chief had begged, borrowed, or rented, all the old lathes he could lay hands on, chiefly from other Corporation Departments, and from consumers who could find no further use for them, but Sandy took the lot without question, and vowed he would make them into proper working lathes again. He saw some prospect at last of realising his life's dream of running a fully equipped workshop. Sandy toiled like a Trojan himself, and he saw to it that his assistants did not slack; though they were all volunteer workers on that job, still they dare not fall out with Sandy, who looked after them like a father, but ruled with a rod of iron, and had an unpleasantly long memory, and a skilful tongue, which could make them writhe.

They were all more or less related to him, or to his wife, he knew all their family histories, and could use that knowledge with biting effect, when any of them showed signs of revolt; besides, Sandy could always manipulate both the paid and the unpaid overtime, and everyone of them had quickly realised that it did not pay to cross the "old man."

In the early days of the war, the Second proposed to Sandy that he should sound the men to see if they would have regular contributions deducted from their pay for the Prince of Wales's fund, and Sandy promptly replied: "You tell me how much you want to raise a week, Sir, and I'll blurry well see that they pay it." The Second made it quite clear that anything that was done must be purely voluntary, and Sandy said that he'd see to *that* all right. Perhaps it was a coincidence that our voluntary contributions put all the other Corporation Departments' efforts in the shade.

In the Second's special file, always locked up, was a genealogical chart showing Sandy's relationship to all his men. It had been slowly constructed after many quiet smokes by the fire in Sandy's office, during the periods of evening peak load, and had cost the Second a good many ounces of a tobacco to which Sandy was very partial, but that chart saved the department a great deal of paid overtime; for example, when the office hot-water radiator system needed overhauling during the Christmas holidays, the Second told Sandy that on no account must the blacksmith be brought in as a stand-by on that job. Now, the blacksmith was Sandy's first cousin, and since he was barred from making overtime, Sandy took care that the carpenter, who was only distantly related to his wife, was not allowed to hang about the job the whole time, but had to open up the floors along the pipe run, and come back after the plumber, who was the wife's brother-in-law, had finished his job.

Sandy could never understand why the Second took sudden dislikes to first one and then another of his men, but he did not know anything about that genealogical tree or connect it with the Second's fondness for family histories, a subject on which Sandy rather prided himself.

The genealogical tree proved very useful during the preliminary work of converting the workshop into a munition factory, and many of Sandy's pet ideas were nipped in the bud, such as making nests of pigeon holes for holding finished shell; that was because the blacksmith was putting in a good deal of overtime at nominal rates, and Sandy wanted to make sure the wife's relatives didn't get off too easily.

When the preliminaries were over, and we settled down to the real business of machining shell bar, the family adjustments threatened to plunge the job into financial disaster, so the Chief intervened, and said the Second would arrange who was to do each operation, and a man once allocated to an operation must not be put on to another without special permission. This quickly improved the output, and reduced the percentage of scrap, because each man had a chance to get expert on his operation, and make quick time; in fact, some of the boys did so well, that the Chief decided to fill up with boys and work the machines the round of the clock. The skilled men on the staff gradually dropped out of the job, on one pretext or another, and as it enabled the munitions to be run in two full shifts, they were allowed to go, and were only brought in to repair any breakdowns in the machines.

ELECTRICAL SHOE MAKING.

By G. BASIL BARHAM.

The installation at the first shoe factory in the world to be equipped electrically throughout has recently been completed, and it is remarkable for the fact that steam and gas have been entirely eliminated for machine heating and power purposes.

In boot and shoe factories steam has hitherto been considered indispensable. Certain operations, as Goodyear welt stitching, Goodyear welting, bottom dryers, box toe steamers, and the steaming of box toes for pulling-over machines, have required, and do require, steam to-day in every factory in the world except the one under notice. But in this factory there is not an ounce of steam used for any purpose except that of auxiliary heating in the depths of winter.

This in itself has saved considerable expense, as even factory plants that employ electric power for driving have hitherto had to keep boilers running in order to furnish steam for the machines mentioned. But under the new conditions there is no need to install steam plant at all, as adequate and cheap systems of electric or gas heating could easily be put in for winter use.

In installing electricity in place of steam in the new factory, one of the greatest difficulties was in connection with the Goodyear stichers. It is, of course, necessary that the thread must be heated and kept "ripe" at all times, and it is also necessary that the wax through which it runs should be kept in a fluid state. This has been done in the new machine, and, according to the operatives, it is carried out to the highest degree of efficiency. There is no risk of the wax pots boiling over, as under the steam process, as the heat can be maintained by the operator at the right temperature without the least trouble. There is no necessity for keeping the windows closed to prevent the machines from cooling, and the operatives can, consequently, work in

greater comfort. The same is true of the Goodyear welting machines, in which it is necessary to keep the thread tempered in a similar manner.

Difficulty was also experienced in connection with the box-toe steamers, steam being necessary to soften the box-toes so as to allow them to be properly worked. This is done in the new electrically-operated factory by a box arrangement in which the toe of the shoe is inserted, and the necessary steam is produced locally by an electric heating element. There is a somewhat similar machine for steaming the box-toes before they go to the pulling-over machines. Then there are the stamping machines, which are heated by electricity instead of steam, as in the past, and, according to an account just received by the writer, the bottom drying apparatus is so designed that it can be made as large as would be necessary to meet the requirements of any factory. Instead of the coils of steam piping that were necessary before the new dryers were put in, there are a number of electric heating elements somewhat similar to those used in connection with the larger electric flat-irons, and these provide a dry heat which is said to do the work much more quickly than that available from steam-heated appliances. Then there is the Gem innersole machine, where it is necessary for an even temperature to be maintained. This is quite a simple matter with the electric heating elements, as it is practically impossible for the temperature to vary.

Another ingenious machine is that used for the bottom filler to replace the former steam contrivance. This requires that the roll be kept warm, the knives at the right temperature, and the filler mixture at the right heat for doing the work; and the report of all who have worked the machine, or seen it in operation, is that it is a great improvement on the machines and methods previously in use.

From a financial point of view the innovation has amply justified itself, as not only is the cost of electrical energy a small matter, but there is the great saving to be taken into account resulting from its being unnecessary to keep up fires in the stokehole to maintain an adequate steam pressure for possibly only a few machines.

ELECTRICAL DEVELOPMENTS IN ITALY.

By E. STRACHAN MORGAN.

The invention of the water-turbine in 1850 was a pre-requisite to the use of water-power for the development of electrical energy. Its substitution for the cumbrous overshot or undershot wheels first made it possible to utilise water-power on anything like a large scale, and the Italians were not slow to appreciate the advantages of this new motor.

By the year 1891 250,000 H.P. were already utilised in this way, but the application of it to industry laboured under one serious disadvantage. The factory had to be taken to where the waterfall was, and the conveyance of the head of water by means of flumes from the narrow valley, where large water-power is for the most part located, to areas better suited for the erection of industrial buildings and more accessible for the supply of raw material, was necessarily restricted in distance. It was not till 1889 that the next great step was taken. In that year the continuous-current electrical installation at Isoverde, above Genoa, the first large one in the world, proved to be the first waving of the magician's wand. In 1890 another important step was taken by the harnessing of the falls of Tivoli, and the conveyance of the energy by alternating current to Rome. At that time it was held to be a marvel to convey the current a distance of 27 kilometres with a pressure of 5,000 volts only, and a leakage of 25 per cent. on the way.

Such a result would now be considered quite contemptible, yet it was a notable landmark, and that enterprise fills the first page of the volume in which will, in all probability, be written the story of the change of Italy from an agricultural country, dotted with some few industries precariously kept in being by a stringent protectionist *régime*, to a great manufacturing State able to hold its own against the countries to which abundance of coal and iron had given what seemed to be an indisputable primacy. As the use of coal and steam extinguished the furnaces of Sussex, so this new force may prove that the waterfall can compete on at least equal terms with the coal mine.

To one looking back on what has been done in the past 20 years, there is unfolded a story of progress sufficiently startling to those who still look on Italy as a mere museum of classical remains and mediæval art, whose inhabitants are making somewhat futile endeavours towards industrial attainment. The men of the next generation will see in a comparison between their installations and those of the past decade a development as surprising as that which separates the old "Puffing Billy" of the Darlington Museum from the engine that whirls the "Riviera" express from Paddington to Penzance. There have been inevitable mistakes on the part of technical men, some inherent in the tentative use of a new instrument, many due to a want of faith in the prodigious powers of that new instrument and the unlimited scope of its possibilities. Their plans were laid on too small a scale; energies were misdirected; companies were often over-capitalised; there was needless and harmful clashing of interests. There is good reason to hope that these lessons have been taken to heart, and that future developments will be carried out on a more systematic plan, embracing all the latent forces of the country. As yet the story of the stupendous work that has been carried out during the war may not be told, but when the veil of secrecy is lifted, it will be realised that the marvels of the *telefériche* on the fighting front have been at least equalled by the manufacturing developments behind.

It must be admitted that in the past the Government has not played a part worthy of it. Red-tape regulations and narrow-minded fiscality have hampered the efforts made to give a free life to the new industry. Two instances may be given of this step-motherly treatment:—(1) In Norway energy is sold at L20 per H.P. per annum. In Italy taxation alone takes more than this. (2) There were a short time ago lying in the Ministero delle Finanze 2,600 demands for water-power concessions, some of which had been on file for more than 20 years. Even by the provisions of the Villa Bill, drafted with a view to simplifying procedure, every demand goes through 12 stages; it goes to the Prefetto, to the Genio Civile, to the Magistrato Supremo delle Acque in Rome, then back to the Prefetto, to the Deputazione Provinciale, then back to the Genio Civile, which at last orders a survey of the local conditions, then back to the Magistrato Supremo in Rome, then to the Ministero dei Lavori Pubblici, then back to the Magistrato Supremo, then to the Ministero delle Finanze, at whose recommendation the concession may be granted by a Decreto Reale. It does not take much knowledge of bureaucratic procedure to realise what considerable possibilities of delay there are even in this "express" treatment of a demand.

In spite of these disadvantages, the progress made in the development of hydro-electricity has been very great. Before giving an account of the work accomplished on the technical side, it will be well to refer to the financial framework on which that development was based, and for understanding this it is necessary to take into account the operations of the Banca Commerciale Italiana, on which all these activities are hinged. And it must be in fairness admitted that a great part of that success is due to Germany. Acting through Italian industrial banks, German capitalists and German industrial

firms canalised the brilliant genius of Italian electricians into industrial channels, and showed them how the science of Galvani and Volta might best be used for the furtherance of national well-being. It is especially owing to this influence that the development of electrical energy has made such great strides during the past 20 years. Not that German capital was largely employed. On the contrary, while English, French, and Belgian capital invested in Italy up to 1913 amounted to about L440,000,000, no more than L44,000,000 was contributed by the Central Empires, but the Italian public, relying on the great ability with which the Banca Commerciale was managed, placed very large deposits under its control, besides contributing important sums to the increase of its capital by taking up new shares as issued. The function of the Bank was, therefore, to provide organisation for the development of the electrical industry and Italian capital for making that development possible. Though the German managers and experts who took part in this development never lost sight of the promotion of German interests, the benefit that they conferred on Italy cannot be called in question. In an article published by Dr. Uebelhor in the *Weltwirtschaft* (January 16th, 1916) on this subject, after a review of the work done by the B.C.I., he wrote:—"How can Italy either in the present or the future develop without German aid? All our information points to the fact that Italy is quite unable to provide a substitute for the support it has lost. Accordingly, we are quite certain that this support will be called in again, and here we may find an answer to the riddle why the Italian Government has not as yet declared war on Germany." The stupendous work which Italian electrical engineers have done in the establishment of munition factories during the past two years provides a very practical rejoinder to the Doctor's query.

How Germany benefited by this arrangement may be seen, in part at least, in the Custom House returns which are quoted farther on. And some hints may there be found as to how English finance and English manufacturers may meet with the heartiest welcome in Italy, and help to further our common object: the development of Italian industries. Be that as it may, the development of electrical enterprise in Italy during the 20 years that followed the bringing in of electrical energy from Tivoli to Rome in 1892 is a story of absorbing interest.

A great impulse was given to this growth by the success of the Brown experiment, 1891-1892, which demonstrated that, by the use of the polyphase system, electrical energy could be successfully distributed to considerable distances. In this particular case the distance was about 100 miles, and the pressure 30,000 volts. Since then the pressure has been increased to over 100,000 volts, and the distance to which energy can be conveyed is only limited by economical considerations.

(To be continued.)

PROCESSES FOR THE MANUFACTURE OF ALUMINIUM.

Most of the aluminium works at present in commercial operation use the Héroult process, very little modified since its introduction in 1876. The raw materials employed, the equipment used, the precautions observed, and the results obtained were described recently by H. Jean Escard.* Alumina (Al_2O_3) in a bath of molten cryolite is subjected to electrolysis, and yields metallic aluminium and free oxygen which burns the carbon electrode to form carbon-monoxide; the latter, in turn, yields carbon-dioxide. The same supply of electrical energy which is used to effect electrolysis is also used to keep molten the salts concerned, but since heavy expenditure of energy is necessary for the double purpose, the process can only be worked commercially where very cheap energy is available. Electrolysis may be effected in a furnace lined more or less completely with carbon connected to the negative pole of the electricity supply. Adjustable vertical electrodes are connected to the positive pole, and aluminium liberated by electrolysis collects at the bottom of the furnace.

It is necessary to maintain close supervision over the composition of the bath. If the alumina content becomes too low, fluoric gases are liberated at the anode, and sodium is deposited at the cathode, where it has injurious influence on the quality of aluminium. Frequent additions of alumina and, when required, of cryolite prevent the occurrence of secondary actions. Experience shows that certain fluxes are essential to success. Calcium fluoride, aluminium fluoride, sodium chloride, and other salts are used in this connection, and in the nature and proportion of the fluxes lies one of the principal differences between the methods employed by various concerns engaged in the manufacture of aluminium.

The two principal phases of the complete manufacturing process are the treatment of the mineral to obtain alumina (which must be in the highest attainable state of purity), and the extraction of aluminium from the prepared raw materials. Bauxite is the mineral universally employed, and if cheap energy be available there, it is obviously desirable to locate the manufacturing works as near as possible to the bauxite deposits.

Treatment of the Mineral.—Bauxite is an impure hydrate of alumina containing from 60 to 80 per cent. of alumina, 2 to 10 per cent. of silica, 10 to 25 per cent. of iron sesquioxide, 10 to 15 per cent. of water, and 1 to 2 per cent. of titanic acid. White bauxites contain silica as the predominant impurity, and are difficult to purify. Red bauxites contain a high percentage of iron sesquioxide (generally 16 to 17 per cent., and sometimes 25 per cent.), and are the form of mineral generally employed. The alumina content should not be lower than 57 per cent., nor the silica content higher than 3 per cent. Rich and poor minerals are mixed to yield the desired average composition.

The purification of bauxite to yield alumina is a delicate and important operation influenced considerably by the peculiar chemical properties of alumina, which is an oxide combining with acids to form aluminium salts, or with strong bases to yield aluminates. Whether hydrated or anhydrous, alumina is insoluble in water. It melts at the temperature of the electric furnace, and is then transformed into a sort of artificial corundum, very hard, and almost unaffected by all ordinary bases and acids.

There are various wet and dry processes for the treatment of bauxite. The Deville process, in which the mineral is first attacked at red-heat by sodium carbonate, is seldom employed at the present day. In the Peniakoff process, which is used by several works, sodium aluminate is prepared from bauxite and sodium chloride. A mixture of bauxite and sodium sulphate is reduced by carbon, or by iron sulphate by heating to 1,200 deg. C. in a rotary furnace. The sulphurous anhydride which is liberated is mixed with air and steam, and directed on to sodium chloride. The products of this action are sodium sulphate, which is used with more bauxite; and hydrochloric acid, which is sold. The furnace product is washed with water to extract sodium aluminate, and alumina is precipitated from the filtered solution, as in the Deville process.

The Bayer wet process is the one most employed. Bauxite is broken up, heated to 700 deg. C., and subjected to the action of soda solution (density 1.4 to 1.45) in a steam-heated digester with agitation. The solution of sodium aluminate thus formed is diluted to 1.25 density and filtered. Under the action of free alumina, and in the presence of an excess of water, the aluminate is hydrolysed, and alumina is precipitated. The Vergé process eliminates the preliminary roasting by using high-pressure steam in the digester.

By whatever means it is obtained, alumina must be calcined (at about 900 deg. C.) in order to make it quite anhydrous. Considerable expenditure of fuel and loss of alumina are involved, so that the final yield is about one ton of alumina from two tons of bauxite. The use of clays (containing 40 to 45 per cent. of alumina) seems to offer promising possibilities of reducing the cost of preparing pure alumina. Nitration processes also offer great possibilities. If bauxite be heated in an electric furnace to 1,800-1,900 deg. C. in the presence of nitrogen, one obtains aluminium nitrate, which may then be digested with soda solution to yield ammonia (from which ammonium sulphate may be prepared for manurial purposes) and sodium aluminate, from which alumina may be precipitated. It is understood that several works are about to use this process, if they have not already commenced doing so.

Cryolite and Fluxes.—Cryolite is double fluoride of aluminium and sodium, and its function is to dissolve alumina for electrolysis. The only known natural deposit of cryolite of any importance is at Ivigtut (Greenland). Most of the cryolite now used in aluminium works is prepared by one or other of several synthetic processes, all of which are based on the use of a fluoride. The Hulin process, used in France by the Société d'Electrochimie, consists in neutralising pure hydrated alumina by hydrofluoric acid. This yields fluoaluminic acid, which is saturated by sodium dioxide to yield insoluble cryolite and pure oxygenated water, which is a valuable by-product.

Natural or artificial cryolite melts at about 1,000 deg. C.,

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Revue Générale d'Electricité, October 13th, 1917, pp. 577-585.

but by adding up to 5 per cent. of alumina the melting point decreases to a minimum at 915 deg. C. Thereafter the melting point rises again to 1,015 deg. C. with 20 per cent. of alumina. There may be a second minimum (980 deg. C.) with 10 per cent. of alumina. In practice, one should keep the melting point between 900 and 950 deg. C., corresponding to from 4 to 6 per cent. of alumina, with a sharply defined minimum for a mixture with 5 per cent. alumina. The melting point may be lowered yet further by the addition of fluxes. For instance, works using the Hall process employ a mixture of cryolite 36 per cent., calcium fluoride 20 per cent., and aluminium fluoride 44 per cent., thus obtaining a bath which melts at 800 deg. C., and dissolves alumina more effectively than cryolite alone. Alkaline chlorides permit the melting point to be lowered to 700 deg. C., but these salts evaporate rapidly, and thus render unstable the composition of the bath. French works employing the Hall process generally use a lower percentage of aluminium fluoride than specified above.

Electrodes.—On the purity of the electrodes, to an even greater extent than on the purity of the alumina and cryolite, depends the quality of the aluminium obtained. The carbon used must be as pure as possible, with little ash and a minimum of iron and silicon. The raw material used may be oil coke, tar, or anthracite. Oil coke is generally preferred. This yields only ½ to 2 per cent. of ash, but often contains 1½ per cent. of sulphur. Volatile constituents amount to 12 or 15 per cent., and are expelled as completely as possible by preliminary heating in vertical retorts. Gas coke is not a good raw material owing to its high silica content.

In making electrodes, crushed coke is mixed with hot tar to form a paste, which is then formed into rods by a powerful horizontal press, cut into lengths, and baked at red heat. An electrode thus made may contain 97.2 per cent. fixed carbon, 1.4 per cent. ash, 0.65 per cent. volatile matter, 0.4 per cent. sulphur, and 0.35 per cent. moisture.

The dimensions of electrodes vary considerably. Sometimes their section is square (say 10 in. × 10 in.), sometimes a rectangular section is preferred (say 4 in. × 3 in.) in order to save weight. There is serious wastage of anodes by burning, and in order to reduce this loss, which amounts sometimes to 1½ or 2¼ lb. per lb. of aluminium produced, some works use anodes in the form of a cube or of a truncated pyramid, with the small end plunged in the bath. The electrode is then almost submerged, and consumption is greatly reduced; if the length be 12 to 20 in. and the side dimension of the section 10 or 12 in., the electrode will weigh 75 to 155 lb.

Excellent connection is needed between electrodes and supply conductors if losses are to be avoided. At the same time, metallic pieces used to make these connections must be protected from the heat of the bath. An axial connection is preferable from this point of view, and it may be made either by screwing a lug into a threaded hole at the end of the electrode (see fig. 1) or by "casting-in" the terminal strip or rod with molten bronze. Either of these arrangements permits the carbon to be used almost completely, which is an important consideration, because the electrodes cost £14 or £15 per ton. If "stumps" of any considerable size are obtained more than occasionally, they should if possible be trimmed up, and then screwed or bolted together in the form of a new electrode. Stumps which cannot be used economically in this manner may be broken, ground, and used in the manufacture of new electrodes.

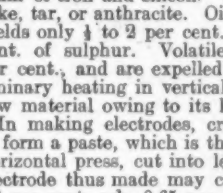

Fig. 1.—Aluminium Furnace with Pisé Bed.

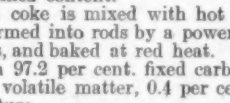

Fig. 2.—Furnace with Sole Electrode.

Furnaces.—There are several types of furnace used in the manufacture of aluminium. One type, illustrated in fig. 1, has a bed *e* of carbon pisé resting on a block of refractory masonry *s*. The latter may be extended up the sides of the furnace, next to the sheet steel casing *p*, in order to reduce the amount of carbon pisé required. The furnace is rectangular in form, with a tapping hole in one long side, and a number of iron plates *f* buried in the pisé to connect the latter to the negative main. The vertical electrodes may be adjusted separately or simultaneously, either mechanically or by hand. A strong framework is needed to carry the heavy electrodes.

The principal disadvantages of this type of furnace are: (1) That since the pisé cannot well be baked except *in situ*, there are volumes of tar vapour evolved each time a fresh lining is put into commission. (2) The pisé never acquires electrical conductivity comparable with that of electrodes extruded under pressure and baked at high temperature.

For these reasons many works employ the type of furnace shown in fig. 2. A thick iron plate *m*, connected to the negative supply main, carries eight or 10 prismatic electrodes *a* (each about 12 in. diameter or side), which terminate flush with the bottom of the furnace trough made by ramming carbon pisé round the sole electrodes as shown. The emission of tar vapour is much reduced, and the electrical resistance of the furnace bottom is almost negligible. There is generally an anode *b*, of slightly smaller section, corresponding to each sole electrode, but the exact arrangement of anodes depends on their size. If the anode section is small (3 or 4 in. side) there may be four rows with 8 or 9 electrodes in each, making a total surface of 2.75 to 3.1 sq. ft. With larger carbons (10 in. side) there may be two rows of five electrodes corresponding to 6.75 sq. ft. surface.

(To be concluded.)

METHODS OF DIRECTING AND CONCENTRATING LIGHT.

By Lieut.-Comdr. Haydn T. Harrison, R.N.V.R.

(Abstract of paper read before the Illuminating Engineering Society.)

During some researches and experiments on the suitability of various light sources for projection purposes, and on the efficiency of various reflectors, lenses, prismatic devices, &c., intended for use with such light sources, I have encountered certain details which may interest those whose business it is to devise and manufacture means for utilising light energy to the best advantage.

Most of my work has been in connection with regular or specular reflectors, such as polished metal or silvered glass surfaces. Such reflectors follow very definite laws, and can be designed and produced on very accurate lines. It was, therefore, not surprising that the light sources with which they were intended to be used claimed more attention than the reflectors themselves.

Some idea of the luminous value obtained by the concentration of light can be gathered from the following table, which has been calculated by dividing the solid angle of the beam produced into the solid angle of luminous flux, which is utilised. Three examples of the latter are given, namely, 270 degrees, 180 degrees, and 90 degrees, being the equivalent of deep, medium, and shallow reflectors. The last type is that generally used in conjunction with the arc for searchlight purposes.

Total Angle of Dispersion. Degrees.	Multiplying Power of Beam. 270 deg.	180 deg.	90 deg.
1	42,675	25,000	7,325
2	11,380	6,600	1,950
3	4,918	2,940	862
4	3,798	1,640	482
5	1,792	1,050	308
10	448	262	77
20	—	65	19
45	—	13	3.86
60	—	7.2	2.1
90	—	3.4	1.0

It is quite usual with shallow parabolic reflectors for the luminous power of the beam to reach 800 times the mean power received from the lamp, showing that the usual dispersion is between three and four degrees. With the more modern lamps the luminous power is increased 1,000 to 2,000 times that of the lamp, owing to its being possible to focus the small light source to less than three degrees.

With metal reflectors of the 270-degree class, a multiplication of 2,000 can be obtained when using small incandescent lamp filaments, but such a small dispersion as five degrees is rarely required for other than signalling work.

Dispersion takes place due to the area of the light source, and as dispersion in any degree must naturally increase the diameter in proportion to the distance, it follows that it increases the area illuminated in proportion to the square of the distance.

From this the two well-known laws are derived: (1) That beams closely approaching parallel can still be considered as following the square law, provided the illumination derived from them is measured at sufficient distance to eliminate any error due to the area of the secondary source or mirror; (2) that the luminous flux from a parabolic mirror focused to small dispersion is proportionate to the square of its area divided by the square of the area of the source.

In an important work by Jean Rey, the whole of the results produced by carbon arc searchlights are based on the relative area of the crater and the mirror, which tends to show that the author was of opinion that the boiling point of carbon represented the highest intrinsic brilliancy likely to be obtained.

It has been my duty during the last few years to develop into practical form a lamp, of which the intrinsic brilliancy per unit area of light bears the relation of 250,000 to 300,000 c.p. per sq. in. compared with 80,000 to 90,000 c.p. with the ordinary arc. Thus it would be unwise to consider the limit of intrinsic brilliancy as having been reached, as it is obvious that future high-efficiency lamps will not depend so much on increase of temperature of the light source as upon modifications in the light wave characteristic.

Apropos of this, it is interesting to note that the progress of gas illumination is largely due to the composition of the gas mantles, which, owing to the proportioning of the constituents, have been improved nearly 50 per cent.

It is probable that increased efficiency in electric lamps will result through increased intrinsic brilliancy; and, as the intrinsic brilliancy of electric lamps is already greater than can be permitted as naked light sources, globes or reflectors will be necessary in the future, and unless much of the efficiency gained is to be lost in such globes or reflectors, it will be necessary to study carefully the laws of reflection and dispersion.

One serious disadvantage of reflectors of the specular type when used in conjunction with filament lamps is that they project a very clear image of the filament, from which it follows that the degree of illumination produced by the beam varies considerably over various parts of the illuminated area. This fault is corrected to a certain extent by using a deep parabolic reflector which, owing to the greater solid angle subtended to the luminous source, not only has a higher efficiency, but also, on account of the greater number of angles from which the luminous flux is projected, superimposes in the illuminated area more varied views or reproductions of the source, thus tending to make the resultant illumination more even.

It is surprising that this type of reflector has not been more used for flood lighting, but probably the reason is that, with gas-filled lamps connected to the usual supply mains, the size of the bulbs would result in the reflectors having to be of deep focus, and therefore of considerable area. Nevertheless, it would appear that efficiency has been sacrificed to a serious extent, and this is witnessed by the figures published by L. C. Porter, Illuminating Engineering Society, U.S.A., June, 1917, which showed that with a 6-volt, 100-watt lamp more than double the beam power is produced than with a 32-volt lamp of the same candle-power when used in a 16-in. reflector of 3-in. focus.

Therefore, unless low-voltage lamps with concentrated filaments can be used, it would appear that flood lighting must continue to rely upon reflectors which receive less than half the total luminous flux.

In the case of headlights, there should be no difficulty in obtaining low voltage for use with special concentrated sources. I have obtained 16-volt gas-filled lamps, averaging 100 c.p., which, with an 8-in. diameter deep reflector, gave as much as 140,000 c.p. as measured by the illumination derived from the beam, and a mean of 76,000 c.p. over six degrees dispersion.

As regards the use of lenses or prismatic combinations in place of, or in conjunction with, reflectors, a long series of tests on those at present available has satisfied me that for projection work short-focus lenses and prisms have two disadvantages: (*a*) light absorption, due to thickness of glass; (*b*) cost, when a lens is combined with annular prisms, as in the Fresnel combination.

To make these successful the lenses and prisms must be small in order to reduce their thickness. Prismatic globes and shades appear to have a considerable future before them, provided the prisms are certainly not larger than those commonly found in Holophane glassware.

The "Pointolite" lamp, as manufactured by Edison and Swan, with a perfect spherical light source of small area, has proved of great value to me when testing reflectors of all descriptions. All irregularity in the illuminating power of the resultant beam disappears, with the exception that the luminous flux in the centre is reduced, due to the two thicknesses of glass through which the beam has to pass. If it were not for the fact that this is an arc lamp, and therefore only capable of absorbing 50 to 60 volts, whereas the supply pressure available is generally nearer 200 volts, this lamp would certainly be the most efficient small-light unit for use with concentrating reflectors or similar devices.

With irregularly shaped light sources the use of translucent globes or screens having internal reflecting surfaces is not so satisfactory as with small sources. It is, therefore, probable that gas-filled incandescent lamps, with their highly concentrated filaments, will make possible the use of many directive and diffusing devices which have proved very unsuitable when used in conjunction with vacuum lamps, owing to the large area over which the light source of the latter is spread. For example, a specular reflector shaped on parabolic lines can be made to concentrate two-thirds of the luminous flux from a half-watt lamp on to a 12- or 14-in. disk of ground or other suitable glass. This surface becomes diffusive, and is therefore suitable for illuminating most interiors from the ceiling. The intrinsic brilliancy of the surface can be regulated by a suitable choice of area. Therefore, without an undue loss of efficiency, the very brilliant gas-filled lamps of to-day can, by this simple contrivance, be converted into a pleasing and efficient illuminating device for interior lighting.

The use of diffusive reflectors to attain the same object, unless of the indirect class, postulates that the light source is visible in certain positions. In order to overcome this, it is usual to make the reflector as deep as possible, thus reducing the angle over which the original light source is visible. By such means it is possible to increase the light flux at angles 30 to 45 degrees below the horizontal to double, or even two and a half times, the mean spherical candle-power of the source. Such reflectors have been very generally adopted, and give excellent results when judiciously spaced.

The use of ceilings as secondary light sources, as in the case of indirect lighting, will probably be largely developed after the war, as the great disadvantage of this system, namely, lack of efficiency, is largely wiped out by the great increase in the efficiency of the original light sources.

A disadvantage of indirect lighting as carried out in many instances is excessive diffusion of the light, thus producing a flat appearance, due to lack of contrast caused by the absence of shadows.

This disadvantage can be overcome by concentrating the light source on to a smaller area of the ceiling, which small area can be specially prepared, or covered with a suitable device, to increase its reflecting efficiency and permit of its being cleaned when necessary in order to maintain such efficiency.

In the indirect lighting fittings supplied by the General Electric Co. of America, which have been designed on very

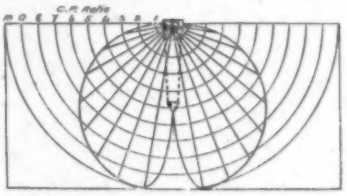

Fig. 1.

sound lines, the lower hemispherical rays are concentrated by means of silvered reflectors, thus reducing the area of the secondary source.

I would suggest the use of an inverted reflector which would receive the luminous flux from, say, 270 degrees solid angle, and concentrate it into a beam having, say, 5 degrees divergence. This, directed on to a suitable diffusive reflecting surface on the ceiling, would produce a secondary light source similar to the crater of the arc, but of greater area and lower intrinsic brilliancy.

The resultant light flux is indicated by fig. 1, where it is shown in a room, say, 10 ft. high and 20 by 20 ft. in area.

I think it will be agreed that the distribution of light would prove very satisfactory. The efficiency, allowing for 15 per cent. loss in the directive reflector, and 20 per cent. in the diffusive reflector, would approach 70 per cent.

The increase in efficiency of artificial light sources also tends towards the increase in power. Thus, it is not unlikely that some of what have hitherto been the favourite methods of interior illumination (such as the use of large numbers of small units placed adjacent to the objects they are required to illuminate) will have to disappear, and modern schemes on quite different lines will take their place.

THE DALMARNOCK POWER STATION.

Mr. W. W. Lackie, chief electrical engineer to Glasgow Town Council, addressed the City Business Men's Club in Glasgow recently, on the new Dalmarnock power station, which is now in course of construction. The first half of the plant will comprise five turbines of 125,000 h.p., and the second half four turbines of 200,000 h.p. Allowing one spare of each size, the station would meet a continuous demand if necessary of 250,000 h.p. The capital cost per horse-power for land, buildings, and plant, excluding mains, in the existing works, he said, was £12, and he did not anticipate any reduction in this capital cost on the first installation in the Dalmarnock works. The existing stations at Port Dundas and St. Andrew's Cross were overcrowded; the canal water at the former was now so much used for condensing purposes that its temperature had been raised to such an extent that machinery in the generating station could not be run in an efficient manner, and the extra coal which had to be used meant an annual addition of £30,000 to the coal bill. At St. Andrew's Cross the cooling towers were taxed beyond their capacity. On account of the ample water supply available from the Clyde, he estimated that a saving of at least £45,000 per annum would be made on the output at present given from the existing works. This would more than pay the interest on the capital now being expended on the Dalmarnock works.

The first half of the station would consist of two boiler-houses placed at right-angles to the engine-room, each containing eight boilers, and the area of ground occupied by the

houses would be about three acres. The turbine-room would ultimately be 450 ft. long, but the first section would be only 250 ft. by 75 ft. broad, or about two acres. A separate building would contain transformers and switchgear. The boilers would be of the Babcock & Wilcox water-tube marine type, and steam would be generated at 275 lb. per sq. in. pressure. The turbine-room would consist of two floors. On the basement there would be the condensers, circulating and air pumps, and other auxiliary machinery, and the main turbines and alternators would be on the upper floor. The best steam consumption yet obtained from a 6,000-H.P. turbine was in the region of 10 lb. per H.P.-hour; the 25,000-H.P. sets were guaranteed, under a penalty of £2,000 per one-tenth of a pound that they were in excess of 7½ lb. per H.P.-hour. This meant a saving of at least 25 per cent. in steam consumption, and, therefore, in the coal bill. From the labour point of view, one man could as easily look after a 25,000-H.P. turbine as a 6,000-H.P. set.

Electrical energy generated at 6,500 volts would be transformed up to 20,000 volts, effecting a great economy in copper. The 20,000-volt switchgear would be the first of its kind, and the first installation would cost £70,000. The spare ground at the site could be used for treating coal prior to burning it in the boilers, and also for electrochemical or electrometallurgical processes. The revenue of the department at present was £600,000 per annum, and when the first half of the Dalmarnock power station was fully in commission the electricity department would be the third Town Council department with a revenue of £1,000,000 per annum.

Mr. Lackie proceeded to discuss the report of the Sub-Committee of the Reconstruction Committee on Coal Conservation, the main conclusion of which was that the maximum economy of the nation's fuel wealth was to be best attained by a universal cheap supply of electricity throughout the country. The scheme outlined was on the right lines, but there would be sharply-defined differences of opinion with regard to the recommendations of the report, which dealt with the question of the ownership and control of the proposed large power stations. The report was quite evidently in favour of these large stations being under the control of private enterprise, while many felt that State or municipal ownership was the better policy. It was assumed that electrical supply could only be operated as a monopoly for two reasons—amongst others: electrical distribution necessitated access to streets and highways which were public property, and the supply of electrical energy was now a public service inseparable alike from industrial development and the amenities of life. The report not only suggested private ownership, but also hinted quite broadly at the need for State subsidy. His opinion was that municipal ownership was the correct policy. It was conceded by the people who lived outside the sphere of vested interests that gas, water, tramways, and electricity should be owned and operated by the local authorities wherever the local authorities were able and willing to do it. So far he had seen no argument in support of a departure from this policy in favour of the old policy of private companies managing public services. One thing was certain—the electrical industry had grown, while the Board of Trade had not. Both company and municipal advocates were agreed that the Board of Trade should have a strong electrical department properly equipped, and should look much more closely into electrical schemes and proposals before sanction was given for borrowing powers. If a cheap supply of electrical energy was available throughout the country, it was hoped that the burning of raw coal by private individuals and firms would cease almost entirely, and Glasgow might then realise one of the greatest desires of the Town Council—a smokeless city.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Openings for Trade in Palestine.

Very many thanks for the ELECTRICAL REVIEW, which has arrived regularly to date, sometimes much delayed as a result of more pressing business on hand, but always a welcome part of the mail.

I am now somewhere in Palestine, and often dream of the chances awaiting the electrical engineer who gets here first later on with resources. There are hundreds of pumping plants crying out for electric drive, and the abolition of messy internal-combustion. Gadgets run—until stopped by a movement of Mr. Atkins—on a wonderful mixture of crude oil and cruder gas, judging by the storage producers one runs across. All these contraptions bear a name-plate, which is anything but British, with a card of regulations governing the movements of the aforesaid printed in several languages, where, again, the British is conspicuous by its absence.

The general idea conveyed is that the agent who dumped the goods had the casting-vote in the lay-out of plant, and sowed his goods with a lavish hand. The idea of a central supply appears to be *non est*, possibly for obvious reasons.

Maybe later on—but, there, the idea is being hammered in, and your journal is doing its share right merrily.

I trust these few remarks will escape the blue pencil, although sufficient has been said to prove the world-wide ramifications of one nation's trade in pre-war days. But seeing is believing, and a little reflection conveys some idea of the industrial "strafe" that is going to follow. Once more, let me convey my best thanks, and those of the many interested readers in our squadron, for your kind interest.

A. P. Holloway.

E.E.F., Palestine.

The 12½ per cent. Award and Clerical Staffs.

I have read with interest the correspondence in your columns with reference to this matter, and I shall be glad if you will allow me to point out to your correspondents what the actual position is as far as clerks are concerned in relation to this award, and to other awards of the Committee on Production.

These awards are issued in respect of applications made, and apply only to the classes of workers represented by the trade unions making the application. Clerks can obtain the 12½ per cent. if they make application through the National Union of Clerks, and already a considerable number of our members are enjoying this advantage. As long as clerks in the electrical trades remain unorganised they will be outside these awards.

Fred Hughes,
Assistant General Secretary,
National Union of Clerks.

13, Brunswick Square, London, W.C.1,
February 27th, 1918.

The Organisation of Electric Supply Staffs.

I was interested to read "G's" letter in your last issue regarding the above, and would like to add my views on the subject.

As "G" points out, the expected developments in national electric supply may give rise to many questions which will involve the interests of both engineering and commercial staffs of electricity supply undertakings, and I think no time should be lost by the commercial staffs in organising for the protection of their interests. At the present time there is no organisation which the commercial staffs of electricity undertakings could join which would be of any assistance to them should occasion arise when the expected developments in national electric supply take place.

I would suggest that the reconstructed "Association of Electrical Power Engineers" might consider the question of forming a commercial section of their Association, comprising commercial assistants, chief clerks and others with technical knowledge employed in electricity supply undertakings. This would be far better than the formation of a new organisation for the commercial staffs themselves, and would enable both engineering and commercial staffs to combine in one for mutual protection of their interests.

Organise.

News from Ruhleben.

In a letter from Ruhleben, dated December 4th, 1915, which you were good enough to publish in your issue of December 17th, an account was given of the activities of engineers here, and of the inception of the "Technical Circle." The interest which, we venture to think, our colleagues at home would feel in any work such as ours, accomplished under abnormal and trying conditions, prompts us to offer them, through the medium of your hospitable columns, a further brief account of our activities during the past two-and-a-half years.

Intellectual activity in this camp has long since been strictly organised. It finds expression mainly through two channels, namely, the Ruhleben Camp School, whose chief object is systematic class teaching, and the Arts and Science Union, including its affiliated "Circles," whose object is largely education in the form of lectures. Practically all technical work of the latter form falls within the scope of four circles, which are, in the order of their formation:—

1. The Marine Engineers' Association (now a local branch of the M.E.A. at home).
2. The Technical Circle.
3. The Science Circle (the medium of the pure scientists and chemists in the camp).
4. The Woollen and Worsted Circle (devoting itself to problems of the textile trades).

The Technical Circle, which now numbers just 100 members, is fairly representative of the mechanical and electrical engineers in the camp. Our object is the exchange and mutual furtherance of technical knowledge. This is being achieved by holding for the most part weekly meetings, at which papers are read and discussed, and, further, by placing at the disposal of members such technical books and periodicals as are obtainable. Since the formation of the circle in July, 1915, 76 ordinary meetings have taken place, with an average attendance of 32 members. A complete list of all the papers read would encroach too much upon your space,

but it may be mentioned that among the subjects that have been treated are:—Steam and water turbines, condensers, the Una-flow engine, various types of Diesel engines, electric generators, rotaries, and motors, switchgears, rheostats, and storage batteries, the applications of electricity in gold mines, in cane-sugar factories, in rolling mills, electric traction, electric welding, electric winders, electric furnaces, submarine cable laying, mining operations, mineral ores, air movers, the uses of oxygen, coal-gas, and liquid fuels. Subjects such as "Track-laying in Canada," and "Irrigation in the Soudan" further indicate the variety of the topics discussed. Debates, a "short-paper" competition, and "questions" evenings have occasionally varied the programme.

Quite a feature of this camp—and we believe of other prisoner camps, too—is the study of languages. Engineers here have shown considerable enterprise in this respect. Several technical lectures read in French have been keenly appreciated, and the arrangement of lectures in the Spanish and Russian languages is under consideration. German technical periodicals are also being read by a number of members.

The various resorts we have sought out for our meetings would appear sufficiently *bizarre* to a member of a home Institution. Our first paper was read in a dark corner of a dilapidated hay-loft, and, as the illustrative diagrams were only imperfectly illuminated by pocket lamps, the event was hardly deemed auspicious. An adjournment was made to a sheltered corner of one of the race-course grand stands. There, grouped on the concrete steps, in a manner reminiscent of the Athenian schools of philosophy, we listened to several lectures during the autumn of 1915. Winter drove us to seek a home in an inhospitable hall, used in the daytime for kinematographic performances; there we met for nearly 18 months. At length we were able to share in the modest equipment of one part of the school premises as a lecture room, and we are now, judging by Ruhleben standards, reasonably accommodated.

The preparation of technical papers is naturally getting increasingly difficult. We have reached a stage where we have almost exhausted the subjects on which our members may lay claim to speak with confidence, if not with authority. Under the circumstances, the Committee of the Circle is following the policy of scrutinising carefully every recent technical journal available, selecting therefrom questions and problems which are coming to the fore owing to the present situation (such as, for example, our fuel supply, means of developing our foreign markets, &c.), and requesting a member to read an abstract of a paper from a periodical, or to open a discussion on some such question. This policy we have found extremely instructive and fruitful. For this reason we wish particularly to thank those editors and publishers who have been kind enough to send us copies of technical journals through the Board of Education. These journals are circulated amongst the members on the system of the private magazine clubs at home, and are very greatly appreciated. Finally, we wish to thank those generous colleagues who have sent us technical books.

We shall soon be entering upon the fourth year of our existence as a Circle, and can look back with some gratification on the work that has been accomplished. It has not been our lot during this time to contribute directly to the advancement of engineering knowledge; but the will to carry on our work and the desire of members to contribute to our proceedings is an incentive to intellectual activity, and has helped in a measure to ward off the appalling state of mental apathy which so easily results from prolonged internment.

We admire more than words can tell the magnificent work done by our colleagues at home during the last three years. Our inability to assist in this work is felt by us all to be our greatest misfortune; it is a feeling which has increased our longing to enter once more upon a responsible occupation. We are earnestly hoping that the day when we can thus return to our legitimate work is not too remote.

We would like to take this opportunity of extending greetings to our colleagues at home, and of wishing them all success in the coming year.

William Eric Swale,
Hon. Secretary to the Committee of the Technical Circle, Ruhleben.

Ruhleben Camp, *December 21st*, 1917.

[We are pleased indeed to hear from our fellow-countrymen who are so manfully enduring their long and weary confinement, and to know that their intellectual pursuits are so admirably organised and energetically maintained, in spite of the difficulties under which they labour. Their record is magnificent, and they have demonstrated afresh the indomitable spirit of the true Briton, who rises superior to all obstacles, and will endure to the end. We look forward to welcoming them home to assist us in the great work of reconstruction.—Eds. Elec. Rev.]

Office Organisation in Municipal Electricity Undertakings.

With reference to the article, entitled "Office Organisation in Municipal Electricity Undertakings," by Mr. G. W. Stubbings, which appeared in your issue of November 16th last, and which probably represents the views of all engineers, like myself, who are in charge of municipal electrical undertakings, I enclose, with the consent of the officer responsible for the finance of the Municipality with which I am concerned, his views on Mr. Stubbings's article, which was given to him for opinion.

I should be greatly obliged if you would kindly publish this letter, together with the enclosure, with the hope of eliciting further criticisms on the subject.

An Engineer-in-Charge.

India.

(Enclosure.)

The procedure in India is quite different to what it is in England, and the supervision by a company is far more rigid than that exercised by a local body. It is obligatory on the part of the directors to scrutinise expenditure closely, because they are responsible to the shareholders that the maximum profit is made from the undertaking. It would be a retrograde step to have a self-contained electricity department, (1) because of the cost, and (2) the absence of the detailed audit which the books of commercial firms go through by a firm of chartered accountants. The Government auditors do a test audit only.

WAR ITEMS.

New York Electric Signs.—New York's "great white way" along Broadway, which has been dim for several weeks, was to resume its brilliancy on March 1st, according to the *Times*, the Fuel Administrator having now permitted the use of electric signs.

Trading with the Enemy.—The "London Gazette" for March 1st contains a further list of persons and bodies in the following countries with whom trading is prohibited:—Argentina, Paraguay and Uruguay, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Guatemala, Hayti, Honduras, Morocco, Netherland West Indies, Norway, Peru, Spain, Sweden, and Venezuela.

Affairs in Petrograd.—*Electricity Supply Failing.*—The latest mail advices from Petrograd on the fuel crisis say the scarcity of fuel becomes more felt day by day. The electric lighting stations work intermittently, and unexpected interruptions in the lighting are common occurrences. The publication of newspapers is seriously delayed owing to the shortage of current. A number of business concerns, particularly small ones, experience great difficulties for the same reason, whilst the town electric tramways are reduced to running short time, and look like stopping completely. The town water system is also seriously threatened through fuel scarcity.

Tramways Lack Competent Engineers.—The stoppage of tramway traffic in Petrograd is the result not only of insufficient fuel, but serious damage at the central station. One of the two new large turbines of the station not long ago got out of order, says the *Nash Vyek*, and it could not be put right by the present tramway board, in which there is not a single experienced engineer. Application had to be made to some private firms, but whether they understand the work is not yet quite clear. The tramways council of management, consisting only of workmen and controllers, are probably beginning to understand that without a scientifically-trained staff it will be difficult to run the business. Anyhow, the council is now trying to engage engineers.

German Industrialists' Plans.—"The methods and plans of the German industrialists are becoming more and more arrogant. Before the war large syndicates—especially the three largest Berlin banks—made several attempts to conclude a watertight agreement which would prevent any one concern from giving employment to the former employés of any rival concern. The Auxiliary Service Law was supposed to have provided adequate guarantees against all such tyranny. Now, however, a journal devoted to the interests of industrial employés has published a secret agreement concluded by 19 of the most important firms in the Berlin metal industry; they include the A.E.G., Borsigs, Siemens und Halske, the Siemens-Schuckert Works, and, indeed, all the well-known firms. The agreement, which took effect from January 1st last, provides that any firm which employs a former employé of another firm, unless the employé has been dismissed by his employer, shall pay a fine to the amount of twice the additional income earned by the employé during the first two years of his new employment. A particularly interesting feature of this secret agreement is that it is to hold good 'during the war with England'—a provision which throws a flood of light on the views of the German industrialists. It is 'the war with England' alone that determines all their calculations."—*The Times* ("Through German Eyes").

War-time Economy must be Permanent.—The Sheffield correspondent of the *Engineer* states that a question that has been raised there is of interest to other districts also. "It is this:—Is the enforced economy in the use of raw materials, in workshop methods, and in the disposition of labour, due to circumstances arising out of the war, to be maintained when peace comes? Viewed in the right light the prevailing rigid economy is a distinct acquisition. Before the war practically nothing was known of it. Here and there an iron or

steel firm framed workshop rules which, carried out, were less wasteful than the average practice, but the spirit of carefulness that has been inculcated since the summer of 1914, if adhered to after the war, will play a very important part in the scheme of reconstruction. Sir Charles Allen, chairman of Henry Bessemer & Co., speaking at the shareholders' meeting, said that as to the future the signs were of a shortage of raw materials. There are very many in the steel trade who take the same view, and it will be remembered that Dr. Addison has expressed himself as being not at all certain that the fears of a fall in values at the end of the war will prove to be justified. Then there is the announcement of Sir Auckland Geddes. It therefore follows that unless the lessons of economy which are now being learnt are remembered and acted upon after the war the steel industry may find itself in a perilous condition; whilst, if any expansion policy is to be successful, it can only be by means of the most rigid permanent economy in raw materials. Moreover, it will hardly be disputed that the cutting out of wasteful methods of manufacture has resulted in the production of a better article, while the more economical use of labour has meant keeping skilled men strictly to skilled work, instead of allowing them to spend large portions of their time upon jobs that could just as well be done by semi-skilled or unskilled labour. Thus, in the scheme of reconstruction, this spirit of economy is destined to play quite as important a part as the more general introduction of labour-saving and output-multiplying machinery, and methods of specialisation and standardisation."

German Electrical Industry during the War.—The German electrical industry, states the *Norddeutsche Allgemeine Zeitung*, was one of the first to be able to accommodate itself to war requirements, partly because in time of peace it was already engaged on work for the Army and Navy. Before long, therefore, despite the depletion of staffs by mobilisation, the existing works were extended to turn out war work, and the expectations of the army authorities were exceeded. A still further increase of output would have been possible had it been necessary.

The electrical industry has provided for the needs of the army directly and indirectly. Under the first head it will suffice to mention wireless telegraphy, field telephony, searchlights, and marine requirements (including certain submarine requisites). In the electrotechnical branch also new demands have arisen, especially for the supply of substitutes to take the place of unobtainable raw materials. Work in the industry is plentiful; it must be remembered that without electricity not a single shell can be turned out, not an ounce of power ground, nor a gramme of nitrate extracted from the air. The works are indeed so busy that they have given up making articles unconnected with electricity, which were made in the earlier part of the war period in order to keep the factories going.

Technical progress has not been hampered by the war. Some of the largest plant in the world has been laid down during the last two years—no small feat when the scarcity of labour and materials is borne in mind. The industry has also surmounted the difficulties presented by the lack of imported materials (*e.g.*, copper, rubber, tin, mica, cotton, resin, and oils). The consumption of these commodities had to be reduced to a minimum, and where possible they had to be replaced by home-grown substitutes. This enforced policy will not be without advantage for German industry after the war, since some of the substitutes have proved equal and even superior to the imported substances.

Prices have been more influenced by wages in the electrical than, for instance, in the chemical, industry. In most other industries prices have been mainly determined by the cost of raw materials. In the electrical trade wages have been the determining factor, and the high wages have forced up prices. This is due in part to the influence of Berlin, where the Government factories, free from the considerations which must guide private concerns, have offered wages higher than anywhere else in the Empire. The war allowances to their employés have added to the expenditure of the private firms; yet, compared with other industries, prices in the electrical trade have been kept within moderate limits.

Prospects for the future are uncertain. It may be assumed that there will be an immense demand for electrotechnical products immediately after the war, so that if the requisite raw material is available the industry will be fully occupied. Whether the boom will continue after the home demand has been satisfied will depend on whether Germany is able to recover her old foreign markets or to acquire new ones. The electrical industry will be more than ever dependent on export trade if it is to retain its former importance.—*Board of Trade Journal.*

Exemption Applications.—At Rochdale, exemption to June 30th was given to the Corporation Tramways Committee for F. Walton (29, C 2), overhead linesman, and R. H. Hogg (38, C 1), motorman.

Before the Herts. Appeal Court, an appeal was made for F. Sandford (32, Grade 3), electrical engineer with Mr. J. B. Joel. It was stated that he had been discharged from the Navy as totally unfit, and was suffering from valvular disease of the heart. It was intimated that such men, discharged as physically unfit for the Navy, were not being called to the Colours pending further instructions. Exemption until August 27th was granted.

At Peterborough, the Electric Traction Co., Ltd., appealed for the retention of J. G. Manning (30, Class A). The manager claimed that the man was in a certified occupation; there were not sufficient cars run for the munition workers, causing the loss of a good deal of time, and things were getting much more difficult than they were. Owing to the shortage of staff, it now took them eight months to build a car. Major Deacon asked if there was not a wounded soldier who could be trained into this skilled work, and the manager replied, "Yes, if you can find us one." He added that Manning acted as a driver from 5.30 a.m. to 6 a.m. Conditional exemption was allowed.

The Oldham Tribunal has granted exemption until June 30th to two drivers on the Corporation tramways, one 37, in Grade 3, and the other 39, in Class B 2.

LEGAL.

F. D. Baldock *v.* the City of Westminster and the Charing Cross, West End, and City Electricity Co., Ltd.

At the Lambeth County Court, on Monday, Judge Hodges delivered a considered judgment in this action for damages to his cab through a collision near Trafalgar Square with an unlighted refuge in the street. A report of the case appeared in our issue of January 25th, page 79.

At the end of a lengthy statement, his Honour, having gone through the evidence very carefully, concluded he could not find a scintilla of evidence that this particular lamp had gone out before that particular night of the accident or that the defendants knew it had gone out or was likely to go out. Nor could he find any evidence that defendants knew, or ought to have known, that it had gone out on the night of the accident before the accident occurred. In the circumstances, he thought it would be unreasonable to hold that the defendants were bound to provide against the contingency of a particular lamp going out, and he did not think there was any evidence upon which a jury could find that the defendants were guilty of negligence in the omission to maintain a danger lamp on the refuge in question. He must, therefore, enter judgment for the defendants, with costs.

Thomson & Son (Motor Factors, Ltd.) *v.* Tarrant & Co.

In the King's Bench Division, on March 4th, Mr. Justice Roche had before him an action brought by Thomson & Son (Motor Factors, Ltd.), of Birmingham and Edinburgh, against Tarrant and Co., Queen Victoria Street, London. Plaintiffs claimed £427 10s. 5d. in respect of 11,324 pocket electric lamp batteries returned as faulty. The defence was that plaintiffs were not entitled to return 33⅓ to 40 per cent. of the batteries, as the seals had been broken contrary to the instruction on the carton.

Mr. Campion, for plaintiffs, read the contract, stating that plaintiffs were to be allowed to return faulty batteries. He said this matter had been before the Master, who made an order that plaintiffs might consent to final judgment for £285, and as to the residue of the claim that defendants should have leave to defend in respect of their contention that plaintiffs were not entitled to return the batteries, the seals of which had been broken. The plaintiffs denied that they had broken any seals. These were American batteries, and it was probable that they were a deck cargo, and that the seals had been broken during the voyage. But, in any case, the plaintiffs did not admit defendants' contention about the seals, relying on the terms of the contract that they were entitled to return any that were faulty.

Mr. H. S. Bond, district manager of the plaintiffs at Birmingham, said that he made the contract with the defendants. He supervised the unpacking of the batteries, of which 11,324 were defective. Many of the seals were found to be broken when the batteries were unpacked. He did not break any of the seals either in unpacking or in testing.

A demonstration was made to his Lordship in Court showing how, by means of an instrument, the batteries could be tested without breaking the seals.

The witness, in reply to his Lordship, said that before the war Germany held the market in these batteries, but after the outbreak of the war America began to send them. The Government allowed 50 per cent. of pre-war imports. Such batteries were now being made in this country.

In cross-examination by Mr. Phillips, witness said his firm did not allow batteries with broken seals to be returned. He attributed some of the broken seals in this case to damp, while others had been damaged on the voyage. The cases in which they came were not damp-proof because they were not tin-lined.

Justice Roche: This was a job lot—cheap, I suppose.

Witness: No; we paid 9s. 3d. a dozen, and they were sold retail at 1s. 3d. each. If the seals were broken, the wholesale people would send them back. Witness recognised that there was a custom in the trade that batteries with broken seals would not be taken back.

Mr. Phillips: Why did you not in writing to defendants say that the seals were broken?—In previous consignments we did not have 1 per cent. broken.

Is not that all the more reason that you should write about it?—They were advised that they were faulty.

The Judge: Do you suggest that he broke the seals?

Mr. Phillips: No; I have no evidence to show that. I say that a considerably greater number now have seals broken than was the case when the witness first examined them. Had there been as many he would certainly have written to say so. It transpired that litigation was pending between defendant and the company in America which supplied the batteries.

His Lordship said he hoped that this rubbish was sent before there was such a shortage of shipping, which he thought might be more usefully occupied. By rubbish he meant things that would not work or which were unimportant.

Mr. J. V. Farrant, one of the defendant firm, spoke of the custom in the trade not to take back batteries with broken seals.

In reply to his Lordship, he said he had a consignment of 900,000, and 200,000 were faulty.

Without calling on Mr. Campion to address him, his Lordship gave judgment. He said it was not disputed that a quantity of the batteries were faulty. The defence that plaintiffs were not entitled to return those the seals of which had been broken failed. He was satisfied that the plaintiffs never broke any seals. Defendants had got hold of a very bad lot. Apart from the fact that plaintiffs had not broken the seals, there was no contract between the parties that if the seals were broken plaintiffs were not to be allowed to send the batteries back. The dealer's notice on the carton was no part of the contract in this case. Judgment had already been signed for plaintiffs for £285, and he now gave judgment for them for an additional £142, making the whole of the sum claimed, £427.

Whittaker v. Accrington and District Gas and Water Board and G. Cunliffe & Sons.

At Accrington County Court, last week, Mrs. Margaret Whittaker, Church, sued the Accrington and District Gas and Water Board, and Messrs. G. Cunliffe & Sons, builders and contractors, Sidney Street, Accrington, for £50 damages for personal injuries. For the plaintiff, it was stated that she was walking on the footpath in Hyndburn Road, Accrington, in August last, and when she was crossing an electric inspection chamber there was an explosion within the chamber. She was thrown into the air, and landed violently in the middle of the road a few yards away. As a result of her injuries, she was unable to follow her work for some time. Opposite the chamber where the explosion occurred was an old mill in course of demolition by Messrs. Cunliffe. On the day of the occurrence some employés of the Gas and Water Board found a leakage of gas in a street some 300 yards away, and when one of the men applied a lighted match the explosion followed. On examining the ground near the old mill it was found that the gas service pipe was broken in two, which, it was contended, was due to Messrs. Cunliffe throwing stone, &c., on the footpath. For the Gas and Water Board, it was stated that there was no gas connection between the two places, but the workman who applied the light said he would not have done so had he known that the electric cables ran that way.

His Honour Judge Hugh Sturges said he was of opinion that the plaintiff was entitled to some compensation, but he would have to consider as to who was liable for the damage. He accordingly reserved judgment.

BUSINESS NOTES.

Controlled Supply of Accumulators.—We learn that restrictions have been imposed by the Ministry of Munitions (Priority Branch), 1, Caxton Street, Westminster, on the sale of accumulators. According to the Order, new accumulators can now only be supplied if the purchasers can furnish (1) a Class "A" certificate bearing a direct Government contract number; (2) a special permit issued by the Priority Department; or (3) an old battery in which the weight of lead exceeds the weight of lead in the new battery by 25 per cent. The new batteries will in this case be known as "replacements," and so neither certificate nor permit will be required.

Brazil.—According to a Consular advice, the gasworks having recently been closed, there is a likelihood of Maranham being illuminated by electricity, so that there will be a considerable demand for everything connected with electric lighting and also with electric traction. The Consul at Para has received an inquiry from an agent in Maranham who wants to represent British manufacturers.

He proposes to open spacious premises as a showroom, where samples, catalogues, and price lists can be shown. [Reference No. 44.].—*Board of Trade Journal.*

Liquidations.—Vaughan Engineering Works, Ltd., Cross Street, Islington, N. 1.—Creditors and shareholders met on March 1st, at the Carey Street offices of the Board of Trade, Lincoln's Inn, W.C. A compulsory winding-up order was made against the company last July, under which accounts had been prepared showing total liabilities £12,960, assets valued at £2,451, a deficiency of £7,147 in assets to meet the liabilities, and a total deficiency of £10,199 as regards contributories. Mr. W. J. Warley, Official Receiver, reports that the company was registered as a private company on May 21st, 1914, with a nominal capital of £5,000, and was formed to carry on the business of electric lighting, heating, ventilating and general engineers. The purchase price was agreed at £3,000, and was satisfied by the allotment of fully-paid shares for that amount. The business was carried on with moneys borrowed on the security of debentures, and appears to have been carried on at a loss throughout. The failure of the company is attributed to losses on contracts due to incompetent estimating by the works managers, and to defective material supplied to the company for the contracts, in consequence of which work was rejected. The liquidation was left in the hands of the Official Receiver.

Rotherham Electrical Engineering Co., Ltd.—The meeting of creditors, called for last Friday, was adjourned for a week, no creditors being present. Unsecured liabilities about £1,000. The assets are book debts estimated at £200 and stock £100.

United Carborundum and Electrite Works, Ltd.—The Controller, Mr. C. Eves, has applied to the Board of Trade for his release.

Moonshine.—Messrs. C. A. Vandervell have sent us some copies of their useful moonlight chart for March.

Trade Announcements.—The Kingsway offices of Messrs. Malcolm & Allan, Ltd., have been taken over by the Government, and their new premises are at Goschen Buildings, 12-13, Henrietta Street, Strand, W.C. 2. Telephone: Gerrard 9486. Telegraph: Rheonalcom, Rand, London.

The Government having commandeered their offices in Imperial House, the National Carbon Co. (J. R. Morris) have temporarily removed to 50, Lincoln's Inn Fields, Sardinia Street, Kingsway, W.C. 2. Telephone number: "Holborn 248."

Messrs. D. H. Bonnella & Son have purchased the goodwill, stock, and plant of the foundry business of Messrs. Eagle & Co., 14, Hanway Place, W., and are retaining the services of all their employés. For the present the business will be continued at the old address, but communications should be sent to Messrs. Bonnella's offices, 58 & 60, Mortimer Street, W. 1.

Messrs. Malcolm & Allan, Ltd., of 499, Eglington Street, Glasgow, have been appointed sole agents for Scotland by Messrs. Automatic and Electric Furnaces, Ltd., for the sale of the Wild-Barfield electric furnaces and steel-hardening equipment. They are installing a demonstration plant at the above address, which can be seen in operation by any of our Scottish readers who are interested in the modern heat treatment of carbon steel.

A new company has recently been formed to take over the patents and goodwill of the R.E.T. Construction Co. Its name is Railless, Ltd., and it will work the R.E.T. system, which has been operating successfully for several years in various towns, including Leeds and Rotherham at home, Boksburg and Bloemfontein in South Africa, and Shanghai in China. At present the work of the company will be to a great extent preparatory.

Bankruptcy Proceedings.—A. E. Felgate, electrical engineer (trading with W. Storey as Felgate & Storey), Reading.—Bankrupt discharged conditionally by order made November 22nd, 1917.

Book Notices.—*Glover's Vade Mecum.* Manchester: W. T. Glover & Co., Ltd. Price 12s. 6d.—The new issue of this excellent handbook has been extended, and thoroughly revised. The copper and aluminium wire tables have been completely overhauled and arranged on a better system, with the British Engineering Standards incorporated, and the text has been largely rewritten, with additions, but rearranged so that much more matter is contained in the same space as before. The information given regarding the protection of underground cables and the methods of laying them is most complete and up-to-date, and the section on jointing cables is equally detailed and full of interesting matter, now including instructions for jointing 20,000 to 50,000-volt cables. The section on colliery cables has been almost entirely rewritten, embodying the wide experience acquired by the firm. The Home Office Rules for mine installations are now followed by the explanatory Memorandum. The section on overhead lines appears to be entirely new, and represents a great advance on the older version, and the section on the maintenance and testing of cable systems has been much improved; on the other hand, the part dealing with interior wiring installations has been omitted, but the I.E.E. wiring rules and other official regulations are given. As a whole, the book forms an admirable pocket companion for the engineer concerned with cables; it was good before, but in its new form, better arranged and printed, provided with thumb index, and brought up to date, it is worthy of the highest commendation.

"Clearing the Ground." By Lumberman. London: Constable and Co., Ltd. Price 7s. 6d. net.

Ignition Magnetos.—The latest addition to the growing list of British makers of ignition magnetos is the Britannic Electrical Co., Ltd., of Warstock, near Birmingham, who have lately produced a machine for use on motor cycles. It is to be known as the "Lion," and is stated to weigh only 5 lb. 3 oz.

Price of Aluminium in U.S.A.—A Reuter dispatch from Washington states that the President has fixed the maximum price of aluminium at 32 cents.

Catalogue.—The Renew Electric Lamp Co., Ltd., Trelco Works, Harrow Road, Willesden Junction, N.W. 10.—Catalogue giving prices of refilling old and worn-out electric lamps.

LIGHTING AND POWER NOTES.

Australia.—In the annual report of the Adelaide Corporation reference is made to the Royal Commission which inquired into the question of municipalising the electricity services of the area. The findings of the majority of the Commissioners were:—That it is not advisable at present to municipalise the undertaking of the Adelaide Electric Supply Co., Ltd., but that legislation should be passed authorising the creation of a municipal trust with power in the future, when desired, to purchase the works of the company with the consent of a majority of the ratepayers interested, after the inspection of the company's affairs and publication of the results of the inspection to the members of the local governing bodies interested.

Barrow.—War Bonus.—The T.C., on Monday last, authorised the 12½ per cent. bonus to be paid to the electricity works employés.

Belfast.—On Monday, the Electrical Committee had under consideration Sir John Snell's report on electrical extensions. The original site for the new power station at Queen's Island having been acquired for shipbuilding purposes, another one, not far from the original site, has been secured, and on its erection and equipment will be spent the sum of £350,000, if Sir John Snell's recommendations are carried out in their entirety.

Birkenhead.—Price Increase.—The Electricity Committee recommends a further increase on pre-war rates of 12½ per cent. to ordinary consumers for lighting, an increase of ½d. per unit to consumers through prepayment meters, and 10 per cent. to ordinary consumers for motive power.

Birmingham.—Price Increase.—Owing to the continued increase in the costs of production, more particularly as to fuel, raw materials, and wages, the Electric Supply Committee has again revised the scale of charges for electricity to consumers. The increase is approximately 15 per cent. on the present scale of charges, which came into force last Michaelmas for low-tension supplies, and is considered immediately necessary. With regard to high-tension supplies, the Committee was advised that the Government Departments concerned were prepared to afford facilities to enable electric supply undertakers generally to revise all the pre-war or long-term agreements, with a view to consumers supplied under such agreements bearing an equitable share of the war burdens carried by electric supply authorities. It was obvious that the extra costs of production and supply should in equity, the Committee stated, be borne by all classes of consumers. In the case of high-tension consumers and the traction supply, the extra cost of fuel was already met by special provision in the agreements, but wages and other additional expenses were not provided for. The Committee, therefore, intended to raise the prices charged to high-tension consumers and for traction supply by 10 per cent., to be added after the Coal Clause had been taken into account. The deposit of a petition in opposition to the Bill of the Shropshire, &c., Electric Power Co. is recommended.

Bournemouth.—Price Increase.—The Bournemouth and Poole Electricity Supply Co., Ltd., announces a further increase in the price of electricity of 5 per cent. from the date of the December quarterly readings, 1917. This makes a total increase on pre-war rates of 25 per cent.

Brighton.—Price Increase.—The T.C. has decided to advance the price of electricity by 15 per cent., to meet the increased cost of fuel, materials, and labour.

Continental.—France.—Owing to the necessity of conserving electric power for war service, the province of Turin, France, has forbidden the use of electricity for any domestic purposes between the hours of 7 a.m. and 8 p.m.

Sweden.—With the object of increasing the capacity of the electric power station at Skultuna to the extent of 50 per cent., the Svenska Metallverkenbol, of Västerås, has recently purchased the undertaking of the Hornsjöfors works.

Darwen.—Price Increase.—The Corporation Electricity Committee has decided to increase the charges for energy by 20 per cent. all round.

Dublin.—Output.—The City Electricity Committee reports that the lighting units for the June quarter of last year showed a decrease of 152,000, and those for the September quarter a decrease of 82,000, as against the respective corresponding periods of 1916. The power units for the September quarter marked an increase of 75,000, but the net income was seriously affected by the general reduction in the use of electricity for lighting. The Committee is not presenting estimates of income and expenditure to the Corporation for the ensuing financial year. The public lighting estimate is given at £33,245, against £21,293 last year; and, in addition, the account to cover war bonuses is set down at £2,964.

Electricity is being installed in the factories of Messrs. Barrington & Sons, Ltd., soap makers, Great Britain Street.

Dundalk.—It was reported at the U.D.C. meeting that special adjustments were being carried out on the Diesel engines in the electric power station, by which it was hoped to reduce the consumption of ignition oil by over 75 per cent., thus effecting a saving equivalent to £600 per annum.

Dundee.—Proposed Extension.—The Corporation Electricity Committee, at its last meeting, agreed that a minor scheme of extension of the works at Carolina Port be proceeded with. Major Harry Richardson, Corporation electrical engineer, who is at present on furlough from the Front, and has been giving close attention to the extension problem, met the Committee and discussed matters with it. At the Committee meeting the hope was expressed that all questions of extension were being considered in relation to the Government's scheme for the establishment of high-power stations in the vicinity of coal mines. Major Richardson said that at the best the Government scheme would be a very lengthy job. They would have to start in the congested districts of England, and the nearest it would get to them for many years would be the Clyde Valley district. Continuing, the Major said they were entitled to ask what the Government intended to do for Dundee and district, and how long they would take to do it. They must go on in the meantime. Dundee power users knew at what rate they were getting their power just now, but they did not know what they would be charged for power under the Government scheme. It was explained that the extension agreed to would form part of the completed extension, so that the expenditure would not be wasted.

Regarding the extension, a correspondent in a Dundee paper revives an old proposal for using water power on the Tay in connection with the city electrical undertaking. He says:—"My plan would be to 'bridle' the rock at the Linn of Campsie by heightening the rock 10 ft. to 20 ft., which would make the river like a loch, with no danger of flooding." As far back as 1890 the same correspondent advocated a similar scheme to give sufficient power to generate electricity to supply Dundee, Perth, &c., and to work the trains on a local railway.

Hitchin.—Proposed Price Increase.—The Electric Supply Corporation has applied for consent to increase the maximum contract rate for energy to 9d. per unit.

India.—A licence has been granted to Messrs. Best & Co., of Madras, to supply electrical energy within the municipality of Trichinopoly, and Mr. Shokalingam Chettyar has been authorised to supply electricity within the Union limits of Karaikudi, in the Ramnad district.

During last month there has been a considerable change in the electric lighting in Delhi, the Local Government, in order to conserve coal, having introduced what is known as the summer scale of lighting, which consists of about one in three of the winter scale.—*Indian Engineering.*

Engineers' Conference.—The third Conference of Government Electrical Engineers has concluded its sittings. The most important business was a meeting, on three days, with a deputation from the Electric Supply and Traction Federation of India, who desired to discuss questions arising out of the provisions of the Indian Electricity Act and Rules and their administration. A deputation from the Bombay Chamber of Commerce and the Bombay Fire Insurance Agents' Association also attended, to put forward views concerning the identification of cables, the licensing of electricians, and the unification of installation rules. A further deputation of electrical contractors put before the Conference their views on certain trade problems in connection with the Government wiring specification. The remainder of the session was occupied with technical discussions and questions of administration. —*Indian Engineering.*

Liverpool.—Price Increase.—The Corporation has given notice of its intention to increase the charges for electrical energy for lighting, power and other purposes, as and from March 31st, 1918, or other the day on which the current quarter shall expire, by a further addition of 17½ per cent. over and above the addition of 12½ per cent. to the charges already in force.

London.—L.C.C.—Loan Sanction.—The Finance Committee recommends the sanction of the Council to the borrowing by the Islington B.C. of £3,571 for mains and transformers, and of £8,000 by the Poplar B.C. for two 1,000-kw. converters.

The Highways Committee reports that Bermondsey B.C. has given six months' notice to discontinue the agreement for the supply of electrical energy for Rotherhithe tunnel.

Londonderry.—Extensions.—The Coporation's Bill has passed the second reading in the House of Commons. The Bill, amongst other things, provides for the raising of a loan of £50,000 for electricity extensions.

Manchester.—Wages.—An application by the Corporation electrical workers for the 12½ per cent. bonus came before the Committee on Production last week. The Corporation stated that the bonus had been paid to all who were entitled to it. The men represented at the application could not legally claim that they were engaged on munition work, and were clearly not entitled to the award. If the application were granted to all who asked for it, the cost would be £148,000, or nearly 8d. in the £ on the rates.

Loan Application.—The Electricity Committee is recommending the City Council to apply to the L.G.B. for sanction to borrow £125,000 for the provision of plant at distributing stations and for extensions of mains.

Potteries.—Linking-up Scheme.—At the last meeting of the Stoke-on-Trent Electricity Committee, it was reported that at a meeting of the Newcastle-under-Lyme Council the agreement submitted was approved, and negotiations were being continued with respect to the Leek linking-up scheme.

Power Bills.—The Shropshire, &c., Power Bill.—Birmingham and Stoke-on-Trent T.C.'s have decided to oppose the establishment of a super power station at Stourport.

The Malvern U.D.C. has decided not to oppose the Bill in its present form.

Salford.—Bulk Supply.—The Electricity Committee has accepted an offer of the Manchester Corporation to supply electricity in bulk up to 2,000 KW. during the first year, 3,000 KW. during the second year, and 4,000 during the third year. The charges are to be for the first 2,000 KW., £2 15s. per KW. per annum; for the third 1,000 KW., £2 10s.; and for the fourth 1,000 KW., £1 10s., together with a charge of 2d. per unit metered. The minimum annual payment to be for the first year £5,500, for the second year £8,000, and the third year £9,500. For every 1s. increase in the cost per ton of coal over and above the first 10s., ·013d. per unit is to be added to the charges. If the agreement is not renewed at the end of three years, any expense in recovering mains shall be borne by each Corporation in respect of the mains in their respective areas. The Salford Electricity Committee has accepted the offer of the Lancashire Electric Power Co. to continue to supply electricity in bulk for a further period of 12 months from April 1st, 1918.

Shipston-on-Stour.—The B. of G. has decided to take electricity for the workhouse from the Electrical Co. at 8d. per unit for lighting and at 5d. for power.

Todmorden.—War Bonus.—The T.C., last week, decided to increase all war bonuses granted to Corporation employés over 18 years to a total advance over pre-war wages of 16s. per week.

TRAMWAY AND RAILWAY NOTES.

B. of T. Tramway Conferences.—A Conference of representatives of the tramway undertakings in the Western Counties was held last week at the Grand Hotel, Bristol, the chair being occupied by Mr. James Devonshire, Chairman of the Tramways (Board of Trade) Committee.

The Chairman said it was of no use for the Government to tell them to maintain themselves if they could not let them have the wherewithal to do it, and he was glad to say there was evidence that something would be done with regard to the rolling stock and rails. In some cases it might be necessary to raise tramway fares. The law officers of the Crown thought they could not invoke the Defence of the Realm Act for that purpose, and the President of the Board of Trade had decided to introduce legislation in that respect. He suggested that resolutions that might be sent up on that point would very much strengthen the hands of the Board of Trade.

Mr. J. B. Hamilton (Leeds) dealt with the subject of labour. He said they would have to release more men by means of substitution or dilution and female labour. The Government would undertake any negotiations with Trade Unions. He added that National Service was going to make Labour Exchanges of vital importance.

Mr. A. L. C. Fell (London) dealt with rolling stock.

Mr. Samuel White (Bristol), responding to the chairman's invitation to speak, said the plan seemed an excellent one to bring the tramway industry together the whole country over. He thought one effect of the movement would be to bring the gentlemen connected with municipal undertakings into closer touch, perhaps with better feeling, with company undertakings. He could say that if there was anything that the Bristol company, being the largest undertaking in that area, could do to help its neighbours, it would be only too happy to do it.

It was resolved to form an Advisory Committee, consisting of the managing director or other officer of each undertaking, Mr. W. G. Verdon Smith, managing director of the Bristol Tramways Co., being unanimously elected as chairman, and Mr. W. E. Hardy, of Bath, as secretary.

Belfast.—At the monthly meeting of the Corporation, last week, it was stated that the financial condition of the tramway undertaking had greatly improved, and it was believed that it had successfully turned the corner. The scheme dividing the electrical department from the tramway department and placing each under a separate Committee was approved of.

Bolton.—Wages.—The Tramways Committee has referred to the Committee on Production an application for the extension of the 12½ per cent. war bonus to unskilled workers employed in the car works and on the repairs and maintenance staffs.

Darwen.—Year's Working.—The receipts on the main line of the Darwen tramways for the municipal year, which closed on February 28th, show an increase of about £2,000 compared with last year.

Edinburgh.—Prov. Order.—The Corporation is to apply for a prov. order to construct tramways from Edinburgh to Queensferry and Port Edgar.

Halifax.—Traffic Congestion.—The Halifax Chamber of Commerce was asked, last week, by Mr. J. W. Galloway, the Corporation tramway engineer, to recommend industrial firms to assist the tramway department in avoiding overcrowding and congestion on the tramways by varying, by a few minutes, the times of commencing and ending work, so that passengers would be distributed over different cars. The Mayor (Alderman H. Clay) supported the appeal, saying that it was impossible to put on more cars under present conditions. The Council of the Chamber decided to recommend manufacturers on the tramway routes to confer and endeavour to meet the need.

Hull.—From Friday, March 14th, onwards, all communications for the Corporation Tramway Department should be addressed to Tramway Power Station Buildings, Osborne Street, Hull.

Hutton Magna.—Application has been made to the B. of T., on behalf of the Hutton Magna Light Railway Co., for extending, for a period of one year from May 17th, 1918, the time limited by Sec. 19 of the Hutton Magna Light Railway Order, 1915, for the completion of the railway authorised by that Order.

London.—Tube Train Fire.—At the Hampstead tube station, on Tuesday evening, a train had just drawn up to the platform when a fire similar to that reported last week was observed in the driving car. The passengers were brought to the surface in the lifts without injury. Dense clouds of smoke ascended through the lift shafts into the street, and a large crowd gathered. The traffic was suspended whilst the damaged train was cleared.

Southport.—Year's Working.—The annual report of the Corporation tramways for the year ended March 31st last shows total revenue £20,962, working expenses (including £803 war service allowances) £13,917, gross profit £7,044; after deducting capital and other charges the net surplus totals £719, as compared with a surplus of £909 the previous year. Total number of passengers carried 5,020,088, as compared with 4,926,961. Average total revenue per car-mile, 10·865d.; average total expenses per car-mile, 10·076d.

Stoke-on-Trent.—The Council has deferred the sealing of the agreement with the Potteries Electric Traction Co. for an extension of the period of the company's running powers in the borough.

Threatened Tramway Strike.—On Saturday last, according to a decision arrived at by their Unions, the organised tramway and omnibus workers of the United Kingdom were to hand in their notices to cease work to-morrow, March 9th. They claim that the Askwith award of January 8th last, granting to commercial vehicle workers a wage equivalent to £1 per week advance over pre-war wages, shall be extended to them, and upon this issue a strike is threatened. Over 70,000 employés are affected. The National Federation of Transport Workers' officials declare that no compromise will be accepted, but, on the other hand, those who control the various tramway and omnibus concerns hope that arbitration may happily lead to a settlement. At a conference held some time ago to consider arrangements for the working of tramways, municipal and privately owned, a zone system was adopted, with the view of meeting the varying circumstances throughout the country, and the suggestion is made that these zone authorities might become the media for negotiation.

"Bonuses which have been granted are included in the £1 asked for, so that in many cases the demand will mean only an addition of a few shillings."—*Daily Telegraph.*

The threatened strike of tramway workers is causing some concern in Lancashire. The conference of Lancashire and Cheshire tramway authorities, 30 in number, some weeks ago, expressed willingness to submit the application to arbitration, and the delay has occasioned some surprise. At a meeting of the authorities on Friday it was decided to send a deputation to Sir George Askwith and Sir David Shackleton, with a view to getting the arbitration fixed as quickly as possible. Meetings of the tramway workers were held last week-end, and a strong lead was given to the executive.

The Leeds branch of the Tramway and Vehicle Workers' Union met on Saturday morning last to consider its position, in view of the national threat. The Leeds men are now getting 15s. per week and the women 12s. The drivers' total for a normal 60-hour week, with war bonus, is £2 12s. 6d., though overtime generally produces more. The women's earnings, in a normal week, are 39s. 6d. The meeting favoured the national demand, leaving the handing-in of notices to the officials of the Transport Workers' Federation. It is admitted that the new development is a considerable surprise to many of the tramway workers.

At a conference of the Amalgamated Association of Tramway and Vehicle Workers and the London and Provincial Union of Licensed Vehicle Workers at Leicester, last week, it was decided to tender seven days' notice, to expire on March 9th, unless a demand for £1 over pre-war rates and proportionate rates for overtime is conceded.—*Evening Standard.*

Walthamstow.—Women Drivers.—The Tramways Committee has received a letter from the Commissioner of Police stating that he is not yet in a position to give any decision with regard to the employment of women as drivers of electric tramcars. He also states that he has no power to issue a driver's licence to any person under 21. The Committee recommends that the Home Secretary be asked to take the necessary steps to give the Commissioner of Police authority to issue licences to women and youths under 21 as drivers of tramcars.

TELEGRAPH AND TELEPHONE NOTES.

Illicit Wireless.—Reuter reports that the Federal authorities in New York have seized the Tower Office Building on Lower Broadway, where a wireless apparatus was discovered sufficiently powerful to communicate with Germany. This wireless plant was in the possession of a certain Richard Pfund, who was at one time manager of the Telefunken plants at Tuckerton and Sayville. Athough the apparatus was disconnected, experts declared that it could be put into operation again within the space of half an hour. Pfund, when questioned on the subject, asserted that he was doing experimental work for the American Navy. This statement was subsequently verified, but the authorities are now making further investigations.

Russia.—The Great Northern Telegraph Co., Ltd., gives notice of an increase of rates to Russia, as from March 1st, to 5½d. and 1s. 4½d. per word for ordinary and urgent telegrams respectively.

Wireless Telegraphy.—Wireless communication has been established between San Diego, California, and Peking, a distance of roughly 7,500 miles, whereby daily communiqués are issued by the American Legation.—*Daily Mail.*

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdare.—March 31st. Electricity and Tramways Department. Stores for 12 months. See "Official Notices" February 22nd.

Australia.—MELBOURNE.—April 5th. Department of the Navy. Motor-driven hydraulic pump.

June 7th. Department of the Navy. Supply and erection of power plant at Garden Island, Sydney. Director of Navy Contracts, Melbourne.

Belfast.—March 13th. Tramways and Electricity Committee. Six or 12 months' supply of stores, &c. See "Official Notices" February 22nd.

Bolton.—March 18th. Tramways Department. Materials and stores for 12 months. See "Official Notices" to-day.

Dublin.—March 8th. Electricity Supply Committee. 1,760 yards of 3½-in. fibrous troughing. See "Official Notices" March 1st.

Fleetwood.—March 11th. U.D.C. Mechanical stoker for the electricity department. See "Official Notices" March 1st.

Lancaster.—March 18th. Tramways Committee. Supply of uniforms. See "Official Notices" to-day.

London.—Office of Works. March 13th. Six months' supply of electric bell fittings. See "Official Notices" to-day.

Macclesfield.—March 18th. Cheshire County Asylum. Stores (10). Electrical goods for six or twelve months. Forms from W. G. F. Tingay, Parkside, Macclesfield.

Manchester.—March 12th. Corporation Tramways. (*a*) Permanent way special trackwork. (*b*) Copper rail bonds. General Manager, 55, Piccadilly, Manchester. Specifications for (*a*) 21s. (returnable).

March 13th. Electricity Committee. (*a*) Low-pressure valves for circulating water pipes for cooling towers. (*b*) Low-pressure water pipes and supports for cooling towers. Specification, &c., from Secretary, Electricity Department, Town Hall.

March 27th. Electricity Committee. Supply and laying of 33,000-volt E.H.T. cable. See "Official Notices" to-day.

Portsmouth.—March 12th. Tramways Committee. Six months' supply of tramway stores. See "Official Notices" February 22nd.

Spain.—April 2nd. Municipal authorities of Don Benito. Concession for the electric lighting of the town during a period of eight years.

Stockton-on-Tees.—March 14th. Corporation. Six months' supply of stores, &c. See "Official Notices" to-day.

CLOSED.

Government Contracts.—The contract secured by the Electrical Apparatus Co., Ltd., and mentioned under this heading last week, was for motor starters, not motors. The item was incorrectly stated in the official publication.

Glasgow.—The Tramways Committee has recommended acceptance of the following offers :—

Armature coils.—Mavor & Coulson, Ltd.
D.C.C. wire for field coils.—B.I. & Helsby Cables, Ltd.
Two sets of fuel economisers for Pinkston Power Station.—Clay Cross Co.

Ilford.—U.D.C. :—

General Electric Co., Ltd.—D.C. switchboard for sub-station, £286; two E.H.T. switch cubicles, £170.
H. Morris, Ltd.—7½-ton overhead travelling crane and rails for the electricity works, £105.

London.—SOUTHWARK.—Borough Council. Siemens Bros. & Co., Ltd. Cable, £106 and £38.

Salford.—Tramways Committee. Accepted tenders for annual supplies :—

Armature coils.—Dick, Kerr & Co., Ltd.; Manchester Armature Repair Co.
Field coils.—Manchester Armature Repair Co.; British Westinghouse E. & M. Co., Ltd.
Commutator spares.—A. Clare & Co.
Insulating tape.—B.I. & Helsby Cables, Ltd.; L. Andrew & Co.; General Electric Co., Ltd.
Air drying varnishes.—Griffiths Bros. & Co. (London), Ltd.
Dry cells.—Western Electric Co., Ltd.
Brake blocks.—National Railway & Tramway Appliances Co., Ltd.
Axle keeps and axle bearings.—Anti-Attrition Metal Co., Ltd.; G. W. Allsop.
Malleable iron castings.—Shotton Bros., Ltd.
Trolley heads.—G. W. Allsop.
Babbit metal.—Phosphor Bronze Co., Ltd.
Steel tires.—Hadfields, Ltd.; Cammell, Laird & Co., Ltd.
Trolley wheel bushes, &c.—Fleming, Birkby & Goodall, Ltd.
Gear wheels, pinion wheels, &c.—British Hele-Shaw Patent Clutch Co., Ltd.; Forest City Electric Services Supply Co.
Pitch, &c.—J. E. C. Lord.
Copper wire.—B.I. & Helsby Cables, Ltd.
Iron wire.—J. Kedd & Sons, Ltd.
Steel wire.—J. Bassett.
Lubricating oil and grease, cork, graphite.—Russell Oil & Chemical Co.
Lubricant colza and machine oil.—L. Bentley & Co., Ltd.

Wathamstow.—U.D.C. Brush Electrical Engineering Co., Ltd. New claw half-coupling for a 1,000-KW. mixed-pressure turbine, £75.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, March 8th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Ordinary meeting.

Salford Technical and Engineering Association.—Friday, March 8th. Visit to Messrs. Mitchell, Shackleton & Co., Vulcan Works, Patricroft.

Birmingham and District Electric Club.—Saturday, March 9th. At 7 p.m. At the Swan Hotel. Discussion on the "Decimal System."

Royal Institution of Great Britain.—Saturday, March 9th. At Albemarle Street, W. Lecture on "Problems in Atomic Structure," by Prof. Sir J. J. Thomson, F.R.S. (Lecture IV.)

Institution of Electrical Engineers.—**(Manchester Local Section).**—Tuesday, March 12th. At the Engineers' Club. At 7 p.m. Paper on "The Control of Large Amounts of Power," by Mr. E. B. Wedmore.

(Newcastle Local Section).—Monday, March 11th. At the Mining Institute. At 6.45 p.m. Paper on "Switchgear Standardisation," by Dr. C. C. Garrard.

(Western Local Section).—Monday, March 11th. At the Merchant Venturers' Technical College, Bristol. At 5 p.m. Annual general meeting. Paper on "The Control of Large Amounts of Power," by Mr. E. B. Wedmore.

(Scottish Local Section).—Tuesday, March 12th. At Princes Street Station Hotel, Edinburgh. At 7 p.m. Paper on "Electrical Signalling and Control on Railways," by Mr. C. M. Jacobs.

(Yorkshire Local Section).—Tuesday, March 12th. At 7 p.m. At the Philosophical Hall, Leeds. Paper on "The Mechanical Design and Specification of the Turbo-Alternator Rotor," by Dr. S. F. Barclay.

Institution of Civil Engineers.—Tuesday, March 12th. At 5.30 p.m. At Gt. George Street, S.W. Exhibition of Kinematograph Films, Illustrating Water-power Works in Canada, by Prof. J. C. McLellan.

British Industries Fair, 1918.—At the London Dock, E. 1, Pennington Street Warehouse (close to Mark Lane Station). Monday, March 11th, to Friday, March 22nd. From 11 a.m to 6 p.m.

Association of Engineers-in-Charge.—Wednesday, March 13th. At 8 p.m. At St. Bride's Institute, E.C. Paper on "The Superintendence of an Engineering Plant at a Large Hotel," by Mr. A. H. Barker.

British Engineers' Association.—Thursday, March 14th. Central Buildings, Westminster. Annual meeting. Address by Dr. Addison.

Institution of Mechanical Engineers.—Friday, March 15th. At the Institution of Civil Engineers, Gt. George Street, S.W. General meeting.

Linking-up in Germany and Hungary.—According to the Stuttgart *Neues Tagblatt*, a meeting of representatives of all electric central stations in Württemberg, Germany, was held recently at Geislingen, at which it was decided to unite under a single management. Lines will be laid interconnecting the various power houses, and arrangements will be made for the most effective and economical production and distribution of the energy generated. A Committee of Representatives has been appointed to work out details for the incorporation of a separate distributing company which will handle the entire production and assign the quantities of energy to be produced by each. Although this situation has been created by the extraordinary war conditions, it is the intention of the Committee to make the arrangement permanent if it proves satisfactory.

A Bill has been passed in the Hungarian Parliament, says the *Budapester Hirlap*, providing for the combination of all electric central stations of the country into one huge organisation. A central management is to take hold of the work, and all cities and towns in Hungary will receive energy for lighting and power from it. The main object is to relieve power houses which are overworked and to assist those in which the demand is not equal to the available supply.—*Electrical World.*

NOTES.

The Industrial Reconstruction Council.—This Council is holding a meeting at the Town Hall, Manchester, on Wednesday, March 13th, at 3 p.m., under the auspices of the Lord Mayor. Mr. G. H. Roberts (Minister of Labour) and Sir William M'Cormick (Department of Scientific and Industrial Research) will be the leading speakers. This is the first of a series of public town's meetings in great industrial centres arranged by the Council with the object of awakening national interest in the vital industrial problems of the immediate future. Applications for tickets should be made to the Secretary to the Council, 8, Bouverie Street, London, E.C. 4.

Applications to the Board of Trade for Increase in Maximum Prices.—Electric supply companies who are making application to the Board of Trade for revision of maximum prices scheduled in their Provisional Orders, or who propose doing so, will be interested in the following communication from the Board of Trade, received by Mr. T. W. Cole, Secretary of the Provincial Electric Supply Committee, with regard to a conference with the Board of Trade on January 16th. The letter sets forth the various particulars required to be furnished by such companies, and the procedure necessary with regard to giving notice to the local authority interested, and runs as follows :—

With regard to the revision of maximum prices, I am to state that the Board have given careful consideration to the suggestion made at the conference that a general Order should be made in the matter, but they are satisfied that the adoption of such a course is not practicable, and that each case must be considered on its merits under the procedure prescribed by the Companies' Acts and Orders.

I am to state that the Board will deal as expeditiously as possible with any application which they may receive for a revision of maximum price.

Each company, when submitting an application, should furnish particulars on the following points :—

1. The amount of dividend paid on the ordinary shares for each of the last five years of account.
2. A comparative statement of receipts and expenditure for the last five years respectively.
3. The proportion of energy supplied respectively—
   (*a*) To contracts with controlled establishments.
   (*b*) Under long-term contracts.
   (*c*) To ordinary consumers.
   (1) For lighting, and (2) for power, with a statement of the prices now charged in respect of each class of supply.
4. The increase in revenue charges per unit generated attributable to increased cost of wages, fuel, oil and plant since the outbreak of war (exclusive of the increase of wages due to the recent award relating to the 12½ per cent. bonus).
5. What the recent 12½ per cent. bonus award will represent per unit generated.

Each company should, at the time of making the application, serve a notice thereof on the local authority for every district in their area of supply, which notice should state that the Board will be prepared to consider any representations which may be made to them in the matter if received within 14 days of the date of the notice.

I am to add with regard to those cases where charges are made to consumers on the maximum demand system, that the Board are of opinion that any general percentage increase which may be added to the consumer's account to cover war contingencies, should not be taken as infringing the provisions relating to maximum price contained in the Companies' Acts and Orders, provided that the average charge per unit to any consumer does not exceed the maximum prescribed.

Industrial Research and the N.P.L.—In a lecture at the Royal Institution, last week, Sir R. T. Glazebrook gave some particulars concerning the future of the National Physical Laboratory. From April 1st its property, now vested in the Royal Society, will be vested in the Imperial Trust for the Encouragement of Scientific and Industrial Research, and its income, including receipts from fees, will be vested in, and under the control of, the Committee of the Privy Council for Scientific and Industrial Research. The scientific control of the Laboratory will continue to be exercised by the Royal Society, and the management will remain in the hands of an Executive Committee appointed as heretofore, and containing representatives of the great technical societies. In the future, as in the past, the Laboratory will endeavour to discharge two functions—it will be a laboratory of industrial research and a national testing institution or proving house. It will be organised in eight different departments, each with its own superintendent and a large staff of scientific assistants and observers. The staff now numbers well over 500 persons, of whom about 180 are women, and the expenditure, which was £5,479 in 1900, will be considerably over £100,000 during the current financial year.—*The Times.*

Economise Gas and Electricity!—In view of the necessity of reducing the consumption of coal, and the labour and transport to handle it, Mr. Guy Calthrop, Controller of Coal Mines, draws the attention of all consumers of gas and electricity throughout the country to the need of the greatest possible economy in their use. He appeals to all classes of consumers to see that every gas burner and electric switch over which they have control is used as sparingly as circumstances will allow. The need for this economy is accentuated where large cities and towns are remote from coalfields, as is the case with London and other cities and towns in the South. As regards lighting, we must limit ourselves to a bare sufficiency, and avoid any approach to brilliant illumination, whether in our dwelling-houses, shops, or public buildings.

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Orders for the week ending March 16th, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Officer for the Week.—Second Lieut. E. A. Ullmann.

Next for Duty.—Lieut. C. E. Campbell.

Monday, March 11th.—No. 3 Company, 6.30—8.30. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30.

Tuesday, March 12th.—Lecture on "Demolitions," at 6.30. Physical Drill and Bayonet Fighting, at 7.30.

Wednesday, March 13th.—No. 1 Company, Knotting, &c., 6.30—8.30. Recruits' Drill, 6.30.

Thursday, March 14th.—No. 2 Company, Knotting, &c., 6—8. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30.

Friday, March 15th.—Musketry, 5.30—8.

Saturday, March 16th.—Entrenchments, &c., for the whole corps, 2.45—4.45. Recruits' Drill, 2.45—4.45.

Special Notice.—All drills will take place at Headquarters, unless otherwise stated.

(By order) Macleod Yearsley, *Capt. and Adjutant.*

An Italian Treason Trial.—Proceedings have been commenced by the Genoa Military Tribunal against the German-Swiss Lokker, a director of the Genoa Electric Works, and Louise Martin for high treason, and against Hubert, the foreman of the works, for damaging the plant.—*Times.*

Samples of Foreign Manufactures.—It will be remembered that not very long after the outbreak of war the Board of Trade Commercial Intelligence Department collected together large numbers of enemy manufactures which had been sold or offered in this country and in Colonial and foreign countries. A fairly representative and interesting exhibition of electrical apparatus and accessories, which was held in Cheapside, formed part of the Department's useful activities in those days. Since then representative collections of the samples brought together in this way have been sent to different parts of this country and to Canada, and we have no doubt that they have been of assistance to manufacturers in various branches of trade. There has now been established on the top floor at 73, Basinghall Street, a Foreign Samples Exhibition, where some of the electrical lines referred to above, and a host of other things such as toys, buttons, paper clothing, small tools, and so on, can be seen by manufacturers and exporters who are interested in knowing the quality, design and style of goods produced by enemy countries to meet the demands of other markets. Some information can be obtained at the exhibition concerning the prices at which certain of the goods were sold, names of British manufacturers of similar lines can be ascertained, and names of probable overseas buyers also. Indeed, a great deal of valuable commercial information can be obtained there—that fact impresses us more than does the handful of electrical articles that are displayed—and we hope that our firms will show an increasing desire to avail themselves of the services which the Department of Overseas Trade, under the controllership of Sir W. Clark, is desirous of rendering. Altogether, the collection consists of about 10,000 articles, and not the least interesting of these are to be found among the 1,000 samples of goods produced by enemy countries during the period of the war.

Shop Stewards in Engineering Works.—The *Times* Manchester correspondent reports that 14 societies connected with the engineering trade, representing 800,000 members, have balloted on the question of including shop stewards among Trade Union officials, and the returns from 11 of the societies show the large majority of 16 to 1 in favour of the proposals. Among the workers who have given their decision are the electricians, tool makers, smiths, strikers, ironworkers, brassworkers, core-makers, enginemen, firemen, finishers, motormen, and labourers.

The functions of the stewards, says the correspondent, so far as they are concerned with the avoidance of disputes will be on the following lines :—

"A workman or workmen desiring to raise any question in which he or they are directly concerned shall in the first instance discuss the same with his or their foreman.

"Failing settlement the question shall, if desired, be taken up with the management by the appropriate shop stewards and one of the workmen directly concerned.

"If no settlement is arrived at, the question may, at the request of either party, be further considered at a meeting to be arranged between the management and the appropriate shop steward, together with a deputation of the workmen directly concerned. At this meeting the organising district delegate may be present, in which event a representative of the Employers' Association shall also be present.

"The question may thereafter be referred for further consideration in terms of the provisions for avoiding disputes.

"No stoppage of work shall take place until the question has been fully dealt with in accordance with this agreement and with the provisions for avoiding disputes."

Tin and Tungsten Research Board.—As the outcome of a conference held on November 7th, 1917, a fund for research has been raised, and a Research Board has been appointed by the Committee of the Privy Council, with Sir Lionel Phillips as chairman. The Board has authorised extended lines of research with a view to increasing the recovery of metal in the treatment of ores.

Appointments Vacant.—Wireman as instructor for training classes for the Wolverhampton Education Committee; two switchboard and sub-station attendants (50s. to 65s.), for the Borough of Salford Electricity Department; armature winder (1s. 3½d. per hour), for the Coventry Corporation Tramways; four wiremen (55s.), for Military Camps in the Winchester District; meter tester (£3), for Corporation of Greenock Electricity Department; meter tester (50s. + 12½ per cent.), for Rochdale Corporation Electricity Department; mains superintendent (£234), for Stoke-on-Trent Corporation Electricity Department; wireman, for the East Sussex County Asylum; wireman, for the Stepney B.C. Electricity Works; draughtsman (£182), for the South Shields Borough Electricity Department; charge engineer and fitter (67s. 5d. + 12½ per cent.) for the West Bromwich Corporation Electricity Department; junior shift engineer (£130) for the Borough of Dover Electricity Works. See our advertisement pages to-day.

Electric Furnace Progress.—The year 1917, says a writer in the *Sheffield Telegraph*, is a landmark in the industrial history of the world on account of the remarkable advance witnessed in the making of electric steel. In the course of the 12 months the number of electric furnaces in operation or being installed increased from 470 to 750. In this progress the most prominent part was taken by the United States, which stands easily first with 233 furnaces, including the largest plant in the world. Canada's furnaces in five years have grown from three to 54, these having an output capacity of 173,000 tons of iron and steel, 50,000 tons of ferro-silicon, and 8,000 tons of ferro-alloys. Great Britain is now second in the list as regards the number of furnaces, having 140; this country is only just realising the immense possibilities of electric furnaces for steel and castings. The serious deficiency of hematite iron will give the electric furnace an excellent opportunity of proving its value. The New York *Iron Age* estimates the number of electric furnaces in use in Germany at 91; Austria, 31; France, 50; Sweden, 50; Italy, 40; Russia, 21; Norway, 12; Switzerland, 4; and Japan, Spain, and Denmark, 2 each.

The need of very high-grade alloy steels for aircraft has given a great impetus to the electric furnace industry in Sheffield. Some of these steels can only be successfully made in the electric furnace, but it is not yet realised that all steels—except the very cheap basic qualities—can with advantage be treated electrically, either completely melting or refining hot metal only.

One firm in the States has under installation a number of furnaces of 15 and 25 tons capacity. The American Navy Department has adopted an English type of furnace—the "Greaves-Etchells"—and is building a number of six-ton units for the Navy yards. The same furnace has also been adopted by Dr. J. A. Matthews, of the Halcomb Steel Co., and by the American Radiator Co.

Throughout America the steel makers are hastening to place themselves in a position immediately to meet the expected call for vast quantities of electric steel on the return of peace. British progress would undoubtedly have been much more marked had not the movement received a check some 12 months or more ago. Numerous applications for permits to install furnaces have been turned down. As a result, many firms desirous of providing themselves with electric melting plant have deferred the matter until the embargo is removed, although they are quite satisfied that for future business the electric furnace is essential for the success of the British steel industry.

New electric furnaces have successfully been started up at the Leyland Motor Works, Leyland, and at Messrs. Stewarts & Lloyds, Ltd., Glasgow. The type in each case was the 3-ton "Greaves-Etchells" furnace; they will both run on high-grade steel castings.

British Industries Fair.—The British Industries Fair opens on Monday next, March 11th, at the London Dock, Pennington Street, London E. 1, and remains open until March 22nd daily from 10 a.m. to 6 p.m. The exhibitors of electrical articles include the British Ever-Ready Co., Ltd., the Efandem Co., Ltd., Metallic Press Work Co., Ltd., Rose Bros., and Ward & Goldstone. There is also a large number of exhibits of electrical and engineering glassware. The right to exhibit has been confined to manufacturers, of whom 425 are present.

Institution and Lecture Notes.—Chief Technical Assistants' Association.—At the meeting held on Saturday last the election of officers took place, with the following result:—

Chairman ...	...	Mr. H. F. J. Thompson (Battersea).
Vice-chairman	...	Mr. J. H. Parker (Croydon).
Hon. treasurer	...	Mr. J. R. J. Bowden (Hackney).
Hon. secretary	...	Mr. A. P. MacAlister (Islington Borough Council, 50, Eden Grove, Holloway, N. 7).
Committee ...	...	Messrs. J. T. Baron (St. Pancras) and J. G. Doran (Bermondsey).

As a result of the expressed desire of the chief technical officers in various undertakings in the United Kingdom, the Association has now extended its membership to undertakings outside the area of Greater London, to which originally the membership was confined. As a result of this extension, and with the support which is foreshadowed, the increased membership will be considerable, and it is believed that it will materially assist in the formation of the future Institution or Association, which is at present being formed. The Association has expressed the desire that any senior technical officer of the grades eligible for membership, whether connected with a municipal or company electric supply, or a traction undertaking, who has not yet received any communication, or who has not communicated with the hon. secretary, will send his name to the hon. secretary.

During the coming session of the Association, many papers on technical matters, especially relating to electricity supply undertakings and their working, will be read and discussed at the meetings. This particular feature of the Association is one which has proved of extreme value, and is most highly appreciated by the members, as it has been very beneficial to assistants in their professional duties, and it is hoped that a scheme, whereby the members of undertakings outside the London area will also be able to benefit equally, will be formulated.

Chadwick Public Lectures, Swansea.—A course of three lectures on "Electricity and National Progress" will be delivered at the Albert Minor Hall, Swansea, on Fridays, March 8th, 15th, and 22nd, by Mr. H. T. Davidge, B.Sc., M.I.E.E.

The 12½ per Cent. Award.—Mr. H. Faraday Proctor, hon. secretary of the Incorporated Municipal Electrical Association, in a letter to the engineer members of the Association, states that the attention of the Council has been drawn to the fact that some persons have construed his circular letter dated January 21st as indicating that the Council is not in favour of payments being advanced to members of the staff receiving a salary exceeding £500 per annum. He points out that the Council makes no suggestions of limitation in this matter, and is desirous of ascertaining, for the benefit of members, what action has been taken in the various undertakings. Inquiry is therefore made as to the classes of employés to whom the 12½ per cent. award, other bonuses, or equivalent, have been paid.

British Engineers' Association.—Dr. Addison, Minister of Reconstruction, will give an address at the annual general meeting of this Association, to be held at Central Buildings, Westminster, on Thursday next, March 14th.

B.A. Meeting Cancelled.—The meeting of the British Association which was to have been held at Cardiff this year has been cancelled.

Australian Industrial Organisation.—Among the decisions of the Australian Trade and Industry Conference are the establishment of a Science and Industry Institute, thoroughly equipped and staffed, and in close touch with the Department of Commerce and Industry and the various industrial associations, and the appointment of trade representatives in the principal oversea markets.—*Times.*

Experiments on Electroculture.—Writing to the *Times Engineering Supplement* of February 22nd, a correspondent discussed the experiments in electroculture carried out by Mr. S. E. Britton, electrical engineer to the Corporation of Chester, and chairman of the I.M.E.A. Committee for the Development of Electricity in Agricultural Areas, suggesting that Mr. Britton, in his report (published in our issue of February 1st, 1918), had undervalued the work done in this connection, including his own, and that the results obtained did not justify his conclusion that the subject was still in the experimental stage, and that much remained to be done before the general application of any such artificial aid to crop growth could be recommended to agriculturists. The writer held that the results obtained were quite good, and clearly demonstrated the beneficial effect of the electric discharge upon crop production. He further stated that arrangements were being made to apply electroculture to an area of 100 acres at Pershore during the coming season, and urged that if electrical manufacturers would concentrate on commercial, rather than experimental, apparatus, at a moderate price, it might be possible for farmers to utilise the system without waiting for the formulation of standard rules for its application.

Replying to this criticism in a letter to the *Times*, Mr. Britton said that it appeared to him that the correspondent had gone out of his way to submit a misleading interpretation of his (Mr. Britton's) report on the Chester experiments and views concerning electroculture, and had attempted to show by inference that the electrical equipment which was being used for this purpose was a sound engineering job from the agriculturist's point of view, and that the subject was sufficiently well understood to warrant adoption on a commercial scale.

With regard to the results of the Chester experiments, he did not consider that these materially assisted in elucidating the reason for the varying results hitherto obtained, but rather tended further to confuse this complex subject. It might, however, be inferred from the results that each variety of potato grown under electroculture required different electrical treatment; should that be the case, then it might further be inferred that other crops would also require different treatment; but, judging by what had already been achieved, there was justification for thinking that when the electrical requirements were more definitely known, and apparatus was made to produce what was known to be required, then electroculture might be expected to achieve abounding advantages to a densely-populated island country such as this. It could not be too clearly stated that there was no published information of any definite form of apparatus required for any particular crop, neither would any manufacturer of the apparatus which was being used for electroculture definitely state what it was capable of producing, and neither could a manufacturer concentrate on commercial apparatus when its requirements could not be defined. It would, therefore, be absurd to expect an agriculturist to

make use of such apparatus on a commercial scale. What was required for further progress was scientific knowledge of the fundamental principles concerning plant life when under the influence of an electric discharge. Until such time, the public should not be encouraged to take up electroculture, and practical experiments should be confined to areas of two to five acres at different parts of the country.

"The reference to the recently-appointed Advisory Committee of the Board of Agriculture I heartily endorse. In March, 1917, the Incorporated Municipal Electrical Association formed a Committee for the Development of Electricity in Agricultural Areas, with power to co-opt members of other societies interested in the subject. The Committee, as now constituted, has representatives of agriculture, botany, engineering, and electricity supply. As chairman, I take this opportunity of pointing out that the Committee was brought to the notice of the Board of Agriculture. For practical purposes it is a pity that it was not consulted, or some member of it appointed to the official committee. Further, most of the members of the I.M.E.A. Committee are having, or have had, experience of the apparatus and of the actual growing of crops, whereas, as far as I am able to ascertain, Prof. Blackman is the only member of the Board of Agriculture Advisory Committee with any experience either of growing crops with electric discharge or of the apparatus required, or of the difficulties which occur in practice.

"The I.M.E.A. Committee is now carrying out experiments to determine the electrical requirements necessary to set up and maintain a definite quantitative electric discharge under different atmospheric conditions. Designs have been prepared for electric ploughing, and cheap and efficient means of supporting overhead transmission lines upon farms. Other important matters connected with electricity in agriculture are receiving the attention of the Committee, and when manufacturers are in a position to undertake new work the Committee hope to make more rapid progress. At a recent meeting a resolution was passed to discourage, for the time being, the adoption of electroculture for other than experimental purposes."

The Restrictions on the Use of Lead-Covered Cable.—Correspondence has taken place between Mr. Thos. Roles and the Secretary of the Cable Makers' Association with regard to the difficulty under which the majority of electricity supply undertakings are now working owing to the fact that, in view of the shortage of lead, the Ministry of Munitions is refusing to grant sanction for the use of lead-covered cable in connection with the extension of mains and the installation of services, except in cases in which the extension or the service is required for urgent war work.

A very great proportion of the undertakings in the country have been using paper-insulated and lead-covered cables throughout on their underground mains systems, and, in view of the restrictions, any extensions and probably repairs to such systems for some considerable time to come will have to be effected by the use of cable which is not lead covered.

Mr. Roles put several queries to the Association, in reply to which the Secretary of the C.M.A., Mr. Ll. B. Atkinson, wrote that in the opinion of his Association it was most important that every possible effort should be made to maintain continuity in the design of cables in use, and suggested that even where the use of lead-covered cables was in the first instance refused by the Ministry of Munitions, in important cases it would be well to make other applications, as it was not believed that the Ministry would desire to run risks of breakdown arising from mixed-up systems. Failing this, however, the Association suggested the following:—

1. That paper-insulated bitumen-sheathed cables should be used up to, say, 2,200 volts.

2. That bitumen-insulated cables should be used for low-pressure work only.

3. That rubber-insulated cables should be used for low-pressure work only.

4. For services the Association suggested bitumen or rubber cables laid in earthenware troughs or drawn into stoneware or cast-iron pipes.

Further, in every case where these formed part of a system where metallic bonding was used, it was desirable either that these other cables should be used with a wire armour or other metallic sheathing, or that they should be drawn into bonded cast-iron pipes, these sheathings and the pipes being connected to the general bonding system. Rubber cables, unless armoured, should not be put into cast-iron or other pipes except for short services.

It was not to be taken that the above list represented in order the merits of the alternatives, and the statement as to pressures must be taken to be general, as in individual cases it might be possible to increase, or in some cases necessary to diminish, those pressures.

With further reference to this subject, the Cable Makers' Association expressed the opinion that it was impossible to obtain satisfactory substitutes for lead-covered cable for extra-high or high-tension work, and that wherever cables were connected to a system where metallic bonding was used, such cables should have steel tapes or wire armouring connected to the general bonding system. Mr. H. Faraday Proctor has ascertained from the Director of Electric Power Supply that, in cases where non-lead-covered cables are used, there will probably be no difficulty in obtaining the authority for steel armouring.

The Council of the I.M.E.A. also holds the opinion that no cable other than that which has a lead sheathing should be used on E.H.T. or H.T. work, but that a leadless cable may be used for low-tension work, provided that it is furnished with armouring and is properly bonded.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—A bonus of £100 has been this week granted to Mr. J. B. Patterson, acting electrical engineer to the Lancaster Corporation, in recognition of his extra services last year during the absence of the engineer, Major G. C. Milnes, M.C., who is fighting with the Royal Lancaster Regiment in France.

By 20 votes to nine, the Edinburgh Town Council has approved an increase in the salary of Mr. Newington, the resident electrical engineer, by £100, to £950.

Mr. G. A. Roberts, acting electrical engineer at Doncaster, who has been with the Corporation for 14 years, has resigned.

Mr. W. Glazier, second charge engineer to the Ilford undertaking, has resigned on account of ill-health.

Mr. C. H. Built has been appointed manager of the Worcester tramways by the Worcester Electric Traction Co., Ltd., in succession to Mr. R. Simpson. He has been in the service of the company since 1904.

General.—To prevent confusion with an electrical firm of similar name, Mr. W. Langdon-Davies has ceased to use this form of signature, and in future wishes to be addressed as "Walter L. Davies."

Sir Charles A. Parsons, K.C.B., F.R.S., has ratified his acceptance of election as a vice-president of the recently-inaugurated North-Eastern Section of the Junior Institution of Engineers.

Barnsley Education Committee has appointed Mr. Herbert Leigh, of Brighton, as teacher of a training course in electrical engineering for disabled sailors and soldiers, at a salary of £15 per calendar month.

A presentation of a gold watch has been made to Mr. G. Rideout, foreman of 30 Shop, Messrs. Siemens Electrical Works, Stafford. The gift, which was made on behalf of the employés by Mr. W. Newman, was to mark their esteem for Mr. Rideout on his departure, after 10 years' service as foreman, to take up an appointment at Wolverhampton. The staff of Messrs. Siemens presented Mr. Rideout with a gold albert.

Mr. Wadeson, who was with Mr. W. M. Selvey, consulting engineer, of Sheffield, has been gazetted captain.

Mr. Hartwell Conder, formerly Tasmanian State mining engineer, has been engaged by the Tasmanian State hydro-electric department to make a geological survey of the storage area of the proposed King River hydro-electric power scheme, designed to supply power for mining and metallurgical works at Zeehan and other parts of the West Coast.—*Australian Industrial and Mining Standard.*

Roll of Honour.—The Croix de Guerre for gallantry in the field has been awarded to Bombardier H. Bromley, R.G.A., who was on the staff of the West Ham Corporation tramways.

Private C. H. Burch, Queen's Royal West Surrey Regiment, who has died of wounds, was for 15 years with Messrs. Tamplin & Makovski, electrical engineers, of Reigate.

Mr. W. Crellin, lost in the sinking of the transport *Tuscania*, belonged to Whitehaven, and enlisted whilst an electrician at Detroit, Michigan.

Second-Lieutenant J. Hardie, R.F.C., who has been killed whilst on a flight from Birmingham to Oxfordshire, was formerly with Messrs. Fraser & Chalmers, of Erith.

The death in action is reported of Lance-Corporal Lovelady, Rifle Brgade, who was employed by the Haslingden Corporation electricity department.

Sergeant R. Tootill, R.F.A., who has been awarded the Military Medal, was employed in the instrument testing department of Messrs. Ferranti, Ltd., Hollinwood.

Private J. Hall, Loyal North Lancashire Regiment, who is officially reported to have died in a German hospital from wounds received in action, was employed by Messrs. Dick, Kerr & Co., Ltd., Preston.

Private J. Fisher, Manchester Regiment, who has been killed in action, was an employé of the British Westinghouse Co., Trafford Park.

Second-Lieutenant S. L. Stern, formerly an assistant engineer with Mr. David Alexander, electrical engineer, Glasgow, has been accidentally killed whilst making a flight in this country.

Lance-Corporal H. Nicholl, West Yorks. Regiment, who, after being missing, is now stated to have been killed, was engaged with Mr. James Tate, electrical engineer, Bradford.

Obituary.—Mr. E. N. Greaves.—The *Times* "Deaths" column contains a notice to the effect that Mr. Edward Neville Greaves, A.M.I.E.E., passed away on March 2nd at Elm Lodge, Town Close Road, Norwich, aged 43 years.

Mr. T. H. Higham.—The death has taken place, at the age of 52 years, of Mr. Thomas Henry Higham, for over 26 years chief electrician to Messrs. C. Tinling & Co., of Liverpool.

Will.—The late Mr. J. S. Sellon, a director of Messrs. Johnson, Matthey & Co., Ltd., left £159,044 gross and £157,880 net personalty.

NEW COMPANIES REGISTERED.

Bristol Institute of Electrotherapeutics, Ltd. (149,723).—Private company. Registered February 27th. Capital, £1,000 in 750 15 per cent. cum. pref. shares of £1 each, and 5,000 def. shares of 1s. each. Objects, as indicated by the title. The subscribers (each with one pref. share) are:—A. G. Partridge, 10, Highcroft Villas, Brighton, certified masseur. National Hospital; Mrs. J. Martin, 33, Holland Road, Hove. The first directors are: W. J. M. Martin and Winifred Higgs. Manager: W. J. M. Martin. Registered office: 22, Holland Road, Hove, Sussex.

Helix Heater Co., Ltd. (149,716.—Private company. Registered February 26th. Capital, £3,000 in £1 shares. To take over the business of a manufacturer of fireproof porcelain for gas and electric heaters, and tiles carried on by the Helix Heater Co. at Wilnecote, Staffs. The subscribers (each with one share) are:—T. W. Robinson, 63, Temple Row, Birmingham, solicitor; J. Dixon, 60, Frederick Road, Stechford, Birmingham, solicitor's clerk. The first directors are to be appointed by the subscribers. Registered office: Prudential Buildings, Corporation Street, Birmingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

A. Vernon-Ward (Manchester), Ltd.—Debenture dated February 15th, 1918, to secure £250 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. Rosenberg, 259, High Holborn, W.C.

Brecknell, Munro & Rogers, Ltd.—Memorandum of satisfaction in full on February 1st, 1918, of debenture dated December 5th, 1912, securing £500, has been filed.

Bastian Electric Co., Ltd.—Issue on February 18th, 1918, of £250 debentures, part of a series of which particulars have already been filed.

Hampson Bros., Ltd.—Mortgage dated January 21st, 1918, to secure all moneys due or to become due from the company to Parr's Bank, Manchester.

CITY NOTES.

Crossley Bros., Ltd.

Sir Kenneth Crossley, in addressing the annual meeting, said that the company were absolutely full up with enough work of the highest national importance to keep them going for the rest of the year. The results for 1917 showed a small improvement on the previous year. They had not made excess profits, but there had been a further big increase in the turnover. They had adopted the right and prudent course in not paying a larger dividend, because of the uncertainties of the future, including the problems of reconstruction, difficulties of changing back from war work to ordinary work, scarcity of raw materials, shortage of shipping for export, and a probable world shortage of capital. Referring to recent discussions about a levy on capital, Sir Kenneth said:—"Naturally the proposition sounds most attractive on the surface to so-called wage earners, but if they will only go a little deeper and study the economics of the question, I think they may alter their views. Putting aside the obvious injustice of confiscating the property of a very large class of people—many of them not so well off as those earning high salaries, or fees, or wages, and the impossibility of realising a fair proportion of such a levy in a useful form—nothing would do more harm to the confidence and credit which our country, above all others, is so dependent on. Surely this war, when we have won it, must be paid for by an expansion of our industries and by the free development of our Empire's enormous resources, and not by discouraging all incentive to individual effort—nothing in the end would react so disastrously on all those who labour with hand or brain."

London Electric Supply Corpn., Ltd.

For 1917 the profit on working is £64,793 (against £55,214 in 1916), plus £7,068 brought forward, less £347 interest on temporary loan. Debenture interest and sinking fund absorb £40,074; 5 per cent. is to be paid on the preference shares, against 4 per cent. for 1916, and £8,980 is to be carried forward. Supply has been efficiently maintained. Units sold 49,013,606, against 49,810,105; total costs per unit sold .79d., against .80d. last year. Average receipt per unit sold (lighting and power) 1.06d., against 1.02d. Expenses of generation, owing to war (principally coal and wages), show an increase of 77 per cent. compared with 1914, viz., from £67,693 to £119,961, while the units sold increased 5 per cent., viz., 46,343,065 to 49,013,606. At the annual meeting on February 26th, Mr. R. H. Benson, who presided, emphasised the importance of cheap supply of power in the London district ready, when peace comes, for reconstruction, that is, for productive purposes in order to repair the waste of the war. The increase of nearly £10,000 in profit was due partly to increase of price for current sold (£217,478 as compared with £212,328), and partly to decreased cost of generation (£119,961 as compared with £127,897). They had had a 150 per cent. rise since 1914 in the price of coal, and 75 per cent. in the cost of labour. There was still 1 per cent. more to be earned before the preference stock got its due, viz., 6 per cent., and, of course, as usual, there was nothing for the ordinary stockholders of the oldest of the London electric supply companies. If in the fourth year of universal war they had been able to more than hold their own, they might look forward with confidence to the future of the corporation when once normal conditions were re-established. Only one thing was needed—a relaxation of the shackles with which, in the imaginary interest of the consumer, the development of power production had been confined from the beginning. That was the point of public interest. It was Parliament's inveterate fear lest the producer should make too much money out of the consumer. As their ordinary stockholders well knew, the producer had not had any sort of return for his enterprise and his cash; the consumer had had it all. Looking back and reading the lesson of history, it was easy to say now that two mistakes were made: (1) Parliament forbade the London companies to amalgamate for the purpose of cheaper production; (2) Parliament reserved an option of purchase now vested in the L.C.C. on the basis of a break-up valuation of the plant in 1931, and no man could say how that valuation would work out. With such uncertainty ahead, when it was necessary to borrow money to pay for more plant, &c., to meet the demand for power, a London company could not offer a security that was certain to be repaid in 1931. "Was it good public policy to keep the London power companies poor, checking their development in order to have the option of buying them up cheaply? The difficulty increases as the day approaches. Instead of first-class, up-to-date plants, the L.C.C. might end in finding only antiquated plant to buy up. But it is not too late." The general principles of the report of the Coal Conservation Committee suggested the formation of new authorities for the generation and distribution of electric supply from large power stations. The suggestion was not a new one. As far as London was concerned, 10 years ago the London electric supply companies, after a considerable amount of negotiation amongst themselves, promoted a Bill in Parliament for the purpose of amalgamating their undertakings, and for working them on the lines generally laid down in the above report. Had that Bill passed, London by now would have had the advantage of one of the cheapest supplies of electric power in the world, with immense saving in coal consumption. Parliament, however, refused its sanction. Yet, in spite of the limitation of their area of supply, the shortness of their tenure, and the withholding from them of the power to amalgamate, they might claim that the average charge for electricity in London compared not unfavourably with that elsewhere, either in this country or any other. For example, the average price per unit received by the London Electric Supply Co. for its total output of units in 1914, viz., 46,000,000, was .94d., while the energy sold for power purposes averaged under ¾d. per unit; and, but for the war, they would by now have reached the minimum amount mentioned in the Coal Conservation Committee's report, and that without enjoying the monopoly which that report now positively recommended. The board would feel nothing but satisfaction in seeing this great and urgent problem tackled on lines so nearly identical with their own suggestion of 10 years ago, and if they were invited to assist in carrying out such a scheme, they would most gladly bring all the resources of their experience and inside knowledge of the conditions into co-operation.

Mr. R. Stewart Bain, the managing director, said that the capital expenditure during the year was £33,000, of which nearly £30,000 was on account of the new 10,000-kw. turbo-generator. This plant was now running. During the year 2,339 h.p. of motors had been connected to the industrial power supply, bringing the total to 20,441 h.p.; orders for an additional 771 h.p. had since been received. The revenue account showed an increase in receipts amounting to £5,600, and a decrease in expenditure of nearly £4,000. Coal was less by over £12,000, not because the price was lower, but because of a satisfactory reduction in consumption owing to the efficiency of new plant brought into commission during the year; and the operation of a coal clause which they had incorporated in all new power contracts, the effect of which was that the consumer paid for the extra price of coal above a standard rate, the receipts therefrom being deducted from the amount paid for coal. Great difficulties continued to be experienced in getting deliveries of coal. The increase in wages since the war started amounted to 74 per cent. as compared with 1914.

Metropolitan Electric Supply Co., Ltd.

Capital expenditure during 1917 increased by £24,754. Gross revenue £318,216, an increase of £40,307. Working expenses £184,543, an increase of £23,534. Balance before providing for depreciation £133,674. £50,000 has been set aside for depreciation and reserve, which fund now stands at £427,359. Including the balance brought forward, interest, and other receipts, £98,224 is available, out of which debenture and loan interest and preference dividend are paid, also a total of 4 per cent. for the year on the ordinary shares, leaving £4,926

to carry forward. New connections 1,414.5 KW., making the total 40,948 KW. The Rt. Hon. F. Leverton Harris, having accepted office in the Government, has resigned his position as a director. Mr. E. Cunliffe Owen, C.M.G., who had been in the service of the company for nearly 30 years, has retired owing to ill-health; Mr. F. Hipwell has been appointed secretary in his place. In order to provide additional working capital, and to pay off loan from bankers, a new issue of debentures, called "Extension Debentures, 1917," amounting to £500,000, has been created, of which £250,000 was issued during the year. Arrangements have been made for the acquisition of approximately the whole of the preference and ordinary capital of the Uxbridge & District Electric Supply Co., Ltd., as at December 31st, 1917, and the purchase will be completed immediately. Meeting: March 11th.

South Metropolitan Electric Light and Power Co., Ltd.

Mr. H. St. J. Winkworth, presiding at the annual meeting on February 27th, said that the number of new consumers was again less than might have been expected, owing to war restrictions on material, &c. To meet conditions, charges for lighting supply had been slightly increased, and the rates to consumers generally had been revised to meet increased production costs. Receipts from sales of current increased by £33,258; units sold were approximately 47 per cent. better than in 1916, and 100 per cent. better than in 1915. Owing to the large bulk supplies the average price obtained fell from 1.6d. to 1.5d. The cost of coal increased by £26,773. There was still difficulty in getting delivery of plant required at the power-house. In regard to the West Kent Electric Co., the number of consumers increased from 1,062 with 3,989 H.P., to 1,092 with 5,599 H.P. The gross revenue rose from £27,677 to £45,139, the expenditure from £22,245 to £38,126, and the net revenue from £5,432 to £7,012. In view of the rapid growth of the West Kent Co.'s business, it applied to Parliament for the removal of restrictions as to capital and for other purposes, and the Royal Assent was given last May. The company had since purchased the freehold of a suitable site, with considerable frontage to the Lower Thames, upon which it was proposed to erect a large power-house to deal with the business on comprehensive lines. It would be built upon the most up-to-date lines, and arranged in self-contained sections. It would be of such size as to make it commercially advantageous for the undertakings adjoining to take supply in bulk rather than to continue their existing small generating stations. Plans were being prepared so that everything might be ready to make a start as soon as opportunity offered. It might not be necessary to add to the plant at the South Metropolitan Co.'s power-house after the present orders were completed, except for the erection of a third large turbine and boilers. The prospects for the current year, so far as gross revenue was concerned, were favourable. Important new business had been secured, but the delay in delivery of power-house plant delayed connections. Mr. H. W. Bowden, the engineer-in-chief, followed with a statement regarding the general working, and produced a number of interesting figures.

Notting Hill Electric Lighting Co., Ltd.

During 1917 the connections increased from 241,859 to 252,307 (30-watt), and the profit from £23,306 to £24,270. The consumers number 4,546, and, with the exception of 18, they are supplied at 200 volts. Revenue from sale of current was £47,916, an increase of £4,731, and the gross profit increased by £964. There has been put to depreciation, renewal and reserve fund £3,000; debenture interest required £1,920; interest and sinking funds for Kensington and Notting Hill Joint Debenture stock amounted to £3,796; income-tax £4,721; distributed under staff co-partnership scheme £166. After paying 6 per cent. on the preference shares, and 3s. per share, less tax, on the ordinary, £1,757 is to be carried forward. The report states that the war bonus to the employés has been increased to 20s. a week, and by a subsequent decision the Government requires electricity supply undertakings to pay a special bonus of 12½ per cent. on all earnings (wages and bonuses), such payment to date back as from October 13th, 1917. To meet this, and the general increase in cost, the company is raising the charge for electricity by an additional 1d. per unit from April 1st, 1918. The case of the Kensington & Knightsbridge Co. respecting the question as to the right of the company to supply current outside the northern boundary of the Notting Hill Co.'s area otherwise than from the joint works, had resulted in judgment in favour of this company, except on two minor questions. The period allowed for an appeal has not yet expired. Units generated or purchased, 3,525,640; units sold, 2,578,295. Annual meeting: March 12th.

Underground Electric Railways Co. of London, Ltd.—The net income for 1917 on revenue, &c., was £602,718, and, after paying interest on 4½ per cent. bonds, 4½ and 5 per cent. notes, Central London guarantee payment, and interest on the 6 per cent. first cum. income debenture stock, 4 per cent. per annum, plus income-tax on the 6 per cent. income bonds, is paid, leaving a balance of £31,140. The income from investments, &c., showed a decrease of £46,631, mainly due to the reduction in the dividends of the L.G.O. Co. from 8 per cent. to 7 per cent., and the Associated Equipment Co. from 14 per cent. to 12 per cent. The aggregate gross revenue of the five companies parties to the common fund authorised by the Act of 1915 was £6,661,863, and the aggregate amount retained by them for revenue liabilities, including reserves, was £6,141,526, leaving £520,337 to be credited to the common fund. This amount was apportioned amongst the five companies as follows:—City & South London Rly., 6 per cent.; Central London Rly., 20 per cent.; London Electric Rly., 30 per cent.; Metropolitan District Rly., 12 per cent.; and L.G.O. Co., 32 per cent. Further extensions of the Associated Equipment Co.'s factory at Walthamstow were carried out during the year, thereby enabling the company largely to increase its output of motor vehicles; but the full benefit of these extensions will only be obtained during the current and subsequent years.

Tyneside Tramways & Tramroads Co.—Presiding at the meeting, Dr. J. T. Merz said that the receipts altogether were something like £11,500 higher than a year ago, the greater part of this increase being received during the latter half of the year; further, the income was still increasing. The greater part of the increase—about 85 per cent.—was from ordinary traffic, probably due to the fact that the railway traffic had been very much reduced, and was more expensive than trams, and also because there was no facility for river traffic. The directors had not hitherto thought it right to deal liberally with the available balance because of the expenses that would be incurred as soon as the war was over in relaying the track; therefore it had been necessary to build up a considerable reserve fund and suspense account, but now there was a sufficient balance left to warrant them in increasing the dividend and paying a bonus. The dividend of 5 per cent. on the ordinary shares compares with 3 per cent paid last year.

Newcastle & District Electric Lighting Co., Ltd.—Adding to the gross profit for 1917 £29,979 brought forward, and deducting interest on debentures and loans, the available balance is £51,096. A dividend of 2½ per cent., less income-tax, is paid, £2,539 is transferred to second mortgage debenture redemption fund, £500 is written off debenture issue expenses, £29,222 is transferred to depreciation and renewals reserve, and £13,257 is to be carried forward. The company has suffered from the continued rise in the cost of wages and materials. £3,000 of the 6 per cent. second mortgage debentures were redeemed during 1917.

Tramways, Light & Power Co., Ltd.—At the recent annual meeting, Viscount Chilston said that, notwithstanding the difficulties, they were able to report very substantial progress. The income from their undertakings showed an increase of £6,943, and the administrative expenses were £1,100 higher. In his opinion, the company was so securely established that shareholders could look forward to the regular payment of the preference dividend half-yearly. The gross receipts for a number of years showed the steady progress of the company:—1913, £14,756; 1914, £28,047; 1915, £30,501; 1916, £35,287; 1917, £42,238.

Oxford Electric Co., Ltd.—Profit for 1917, including £645 brought forward, £11,367. After paying the debenture and preference interests, 5 per cent., less tax, on the ordinary shares, putting £416 to reserve and renewals, and writing £450 off hire-purchase installations, £751 is to be carried forward. Revenue from sale of electricity advanced, but the profit seriously diminished, owing to cost of labour, fuel, and commodities generally.

Bruce Peebles & Co., Ltd.—The trading profit for 1917 was £23,617. After deducting administration expenses, interest accrued on unsecured debentures, and depreciation, the net profit is £14,584, which is subject to excess profits duty and control taxation for 1916 and 1917. The results are considered satisfactory having regard to the abnormal times and difficulties. Annual meeting: March 15th.

Davis & Timmins, Ltd.—Net profit for 1917, including £23,070 brought forward, after allowing for depreciation and other charges, £84,247. Dividend for the year, 8 per cent., free of tax, and a bonus of 17 per cent., free of tax, carrying forward £59,983, subject to special taxation.

British Insulated & Helsby Cables, Ltd.—Final dividend of 7½ per cent., together with a bonus of 10 per cent., making 25 per cent. for the year, against 20 per cent. for 1916.—*Financial Times.*

Electrical & Industrial Investment Co., Ltd.—Dividend, 5 per cent. on the preferred ordinary shares, carrying forward £13,469.

Bournemouth & Poole Electricity Supply Co., Ltd.—Final dividend on the ordinary shares at the rate of 7 per cent. per annum, less tax, for the December half-year, making 6 per cent. for the year

Para Electric Railways & Lighting Co., Ltd.—Owing to the delays in mails the audited accounts from Para have not yet been received, and in consequence the report for the year ended November 30th last and the payment of the usual dividends on the preference and ordinary shares have to be postponed.—*Financial Times.*

Stock Exchange Notice.—Application has been made to the Committee to appoint a special settling day in:—

Marconi International Marine Communication Co., Ltd.—250,000 additional shares of £1 each, fully paid (Nos. 350,001 to 600,000).

South London Electric Supply Corporation, Ltd.—For 1917 the gross receipts were £66,658, and the expenditure was £35,717. Including £3,053 brought forward, the amount available is £33,994. After putting £7,000 to depreciation, paying the 6 per cent. preference dividend, also debenture and other interest, £2,500 is put to general reserve, 5 per cent. is to be paid on the ordinary shares, and £3,425 is to be carried forward. New connections representing 24,741 lamps (35-watt), or 870 KW., were added during the year, making 417,740 lamps (14,600 KW.). Units sold 7,549,945—increase 851,583, or 12.7 per cent. Units generated 9,611,090. Meeting: March 12th.

STOCKS AND SHARES

TUESDAY EVENING.

THE visit of the "Tanks" to the City has not had the unfavourable effect upon business in the Stock Exchange which most of us expected. Indeed, business in gilt-edged securities is fairly good, prices are well maintained, and even the Russian affair is momentarily relegated to the background as a bear point. Confidence appears to be returning to various sections of the Stock Exchange, which is another way of saying that there is more business about. Industrials continue to command the greatest part of the activity prevailing, but so far as electrical issues are concerned, there has been something of a decline in the shares of the manufacturing companies, more especially those which were run up sharply two or three weeks ago.

The report of the Underground Electric Railways Co. was not received with unmixed satisfaction, and hints were thrown out that there might be a protest at the meeting this week in regard to the interest on the Income Bonds being no more than 4 per cent. The meeting, therefore, is awaited with more than usual interest. Lord Farrar's reference to the probability of fares being raised has had the effect of putting up the price of the company's £10 shares to 14, thus showing a rise of 2s. 6d. on the week, but the 1s. shares are weaker at 5s., and the Income Bonds at 79¼. Districts are dull at 15; Metropolitan Ordinary Stock is ex dividend. The Surplus Lands is better at 49.

Dividend declarations come freely from the electric supply companies. The City of London has declared a dividend of 10 per cent., making 8 per cent. for the year, the same as before. The South London is paying 5 per cent., the South Metropolitan 6 per cent., which is an increase of 2 per cent., and the Notting Hill Co. announces 3s. a share. The South London will distribute 5 per cent. on its Preference, against 4 per cent., and the dividend on the St. James's and the Westminster Companies of 11 per cent. and 10 per cent. respectively make 9 per cent. for the year in both cases, as against 8 per cent. and 7 per cent. for 1916. The market is steady as a whole, except in the case of City of London Ordinary, where a couple of hundred shares came in. This was something of a line for times like the present, and the price receded ¼ to 13.

The Westminster Electric Supply Corporation is inviting the holders of its 3½ per cent. Debenture Stock to accept 97 for their security now, instead of waiting until March, 1920, when the stock will be repayable at 100. Having regard to the anxiety of everyone to do as much as he can in the way of taking up National War Bonds, it is likely that the company's suggestion will be readily accepted, because the option is, if anything, slightly in favour of the proprietors taking advantage of the offer. Incidentally, the inference is obvious that the Westminster Corporation must be in an excellent financial position to be able to repay in cash the debentures still outstanding.

The feature amongst stocks and shares connected with the cable industry is a further rise of 50s. in Henley's to the round £20 per share, due, of course, to the exceeding juiciness of the melon which the company is cutting for the benefit of its shareholders. The savour has spread to Callender's, and has caused a rise in them of 30s. India-Rubber shares are also 5s. up at 15. On the other hand, the electrical manufacturing group, as already pointed out, has given way, and British Westinghouse Preference lost the 3/16 which they picked up last week, the price having receded to 2 15/16. Electric Constructions weakened to 25s. Edison Swan fully-paid fell to 2¼, and other members of the group are also out of favour for the time being. Marconis have improved to 3 1/16, but the market for American Marconis is dull at the moment, and the price, after being 25s. 3d., has gone back to 24s. 9d. United River Plate Telephones fell 3/16 to 6 13/16 on a few sellers coming to market simultaneously, and in the general list of cable stocks no other changes have occurred.

London United Tramways Debenture is in considerable demand, and the price, which stood at 30 not long ago, has risen to 42½, without tempting out any noticeable amount of stock. Much curiosity is expressed as to what may be in the wind to account for this sudden revival. Amongst the foreign issues, Mexican Tramways Common receded to 28. British Columbia Deferred, after being 30, fell back again to 28, but the company's Preferred Stock is a point to the good at 31½, and the Preference shows a similar rise at 53.

Rubber shares are weak and friendless, notwithstanding a rise in the price of the material to 2s. 5½d. per lb. Shares are freely offered, and buyers are coy. There has been an all-round improvement in the shares of the gunpowder companies included in what is known as the combine, advance details having leaked out as to what the various companies are likely to receive when the new concern makes its appearance. Armaments, on the other hand, have reacted. Base-metal shares are mostly firm, but there is nothing of outstanding interest upon which to comment.

SHARE LIST OF ELECTRICAL COMPANIES

	Dividend 1915.	Dividend 1916.	Price March 5, 1918	Rise or fall this week.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	10	9	6¾	—	£6 13 6
Charing Cross Ordinary	5	5	4	—	6 5 0
do. do. do. 4½ Pref.	4½	4½	5	— ½	7 10 0
Chelsea	4	5	1¾	—	5 4 4
City of London	8	8	12	— ½	6 3 1
do. do. 6 per cent. Pref.	6	6	10½	—	5 13 6
County of London	7	7	11¼	—	6 4 0
do. 6 per cent. Pref.	6	6	10½	—	5 13 5
Kensington Ordinary	7	6	8¾	—	5 11 7
London Electric	5	Nil	1¼	—	Nil
do. do. 6 per cent. Pref.	6	4	3½xd	—	8 0 0
Metropolitan	5	5	5¾	—	4 12 4
do. 4½ per cent. Pref.	4½	4½	5¾	—	6 13 4
St. James' and Pall Mall	8	8	9½xd	—	6 6 4
South London	4	5	5¾	—	6 13 4
South Metropolitan Pref.	7	7	9½-xd	—	6 13 4
Westminster Ordinary	7	7	6¾xd	—	6 18 4
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	9¼	—	6 7 0
do. Def.	33/6	1½	12½	—	6 13 4
Chile Telephone	8	8	7½	—	5 10 4
Cuba Sub. Ord.	5	7	9½	—	*7 11 4
Eastern Extension	8	8	12½	—	*5 6 0
Eastern Tel. Ord.	8	8	122½	—	*5 6 7
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 5
do. Pref.	6	6	10½	—	5 14 6
Great Northern Tel.	23	24	86	—	6 11 6
Indo-European	13	13	51½	—	6 6 3
Marconi	15	15	3 1/16	+ 1/16	4 18 0
Oriental Telephone Ord.	10	10	44	— ¼	5 17 2
United R. Plate Tel.	8	8	6 13/16	— 3/16	*5 17 4
West India and Pan.	6d.	6d.	1½	—	*2 13 2
Western Telegraph	7	8	16½	—	*5 5 0
HOME RAILS.					
Central London, Ord. Assented	4	4	6½	—	6 9 1
Metropolitan	1	1 •	2½xd	—	4 13 0
do. District	Nil	Nil	15	— ½	Nil
Underground Electric Ordinary	Nil	Nil	1¼	+ ¼	Nil
do. do. "A"	Nil	Nil	5/-	— 2d.	Nil
do. do. Income	6	4	7½	— ¼	5 6 8
FOREIGN TRAMS, &c.					
	Dividend 1915.	Dividend 1916.			
Adelaide Sup. 6 per cent. Pref.	6	6	4¾	—	6 3 1
Anglo-Arg. Trams, First Pref.	5¾	5¾	9⅝	—	—
do. 2nd Pref.	5¾	—	2¼	—	—
do. 5 Deb.	5	5	66½	+ ½	7 10 6
Brazil Tractions	4	4	45	—	—
Bombay Electric Pref.	6	6	9½	—	6 5 4
British Columbia Elec. Ry. Pfds.	5	5	53	+1	9 8 6
do. do. Preferred	Nil	Nil	31½	+1	Nil
do. do. Deferred	Nil	Nil	28	—	Nil
do. do. Deb.	4½	4½	60	—	7 1 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	37	—	Nil
do. 6 per cent. Bonds	Nil	Nil	34½	—	Nil
Mexican Light Common	Nil	Nil	17⅛	—	Nil
do. Pref.	Nil	Nil	29	—	Nil
do. 1st Bonds	Nil	Nil	38	—	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	8⅞	—	4 10 4
British Aluminium Ord.	7	10	11¼	—	6 0 9
British Insulated Ord.	17½	20	83	—	5 6 8
British Westinghouse Pref.	7½	7½	2 13/16	— 3/16	5 2 0
Callenders	20	20	17⅛	+1½	5 14 3
do. 5 Pref.	5	5	4	—	5 5 0
Castner-Kellner	27	20	8⅞	—	5 12 2
Edison Swan, fully paid	—	—	2½	— ¼	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	7½	1½	— ¼	5 0 0
Gen. Elec. Pref.	6	6	109	—	5 15 8
do. Ord.	10	10	19½	—	5 2 7
Henley	35	35	20	+2½	6 5 0
do. 4½ Pref.	4½	4½	8¾xd	—	5 13 2
India-Rubber	10	10	15	+ ½	*6 13 4
Telegraph Con.	20	20	43	—	*5 11 9

* Dividends paid free of income-tax.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	Inc.
		£	£		£	£		
Bristol	...	...	...	...	...	...	...	...
Cork	...	...	...	...	...	...	...	...
Dublin	Feb. 23	23,759	- 6,493	8	84,559	+ 5,731	...	...
Hastings	„ 25	3,666	+ 664	8	7,473	+ 589	...	...
Lancashire United	„ 27	40,408	+3,306	9	20,747	+ 6,481	...	...
Llandudno-Col. Bay	„ 23	980	+ 318	12	2,764	+ 845	...	...
Anglo-Argentine	„ 25	218,729	+13,906	8	625,144	+24,972	...	...
Auckland	Oct. 26	23,80-	+ 880	17	92,118	+ 7,822	...	...
Calcutta	Feb. 20	19,182	+ 780	...	...	1,161	...	...
Kalgoorlie, W.A.	Oct.	2,795	...	10m	26,923	...	...	...
Madras	Feb. 15	2,470	— 82	6	7,709	+ 681	...	...
Montevideo	Jan.	36,016	+2,675	13	101,101	+ 7,992	...	...

SWITCHGEAR STANDARDISATION.

By CHARLES C. GARRARD, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

(*Concluded from page* 199).

Cut-outs.

While the standardisation of cut-outs has been carried out to a considerable extent in other countries, with us practically nothing has been done.

Many electric supply authorities issue their own specifications for house service cut-outs, necessitating special drawings, patterns, and tools. The same remarks apply to house-service cable boxes, main switches, and the like. It is perhaps too much to hope that all this can be swept away, within a reasonable time, simply by the issue of specifications by the Engineering Standards Committee. An energetic propaganda among the responsible parties will be necessary to secure the desired results. These could best be obtained probably if supply engineers could be induced to take the matter up themselves with the object of securing uniformity as regards house-service fittings. By these means very valuable information could be made available which would guide the Engineering Standards Committee in its preparation of the final specifications.

In this connection it is interesting to note that the Municipal Tramway Association has appointed recently a committee to deal with the standardisation of overhead construction, which proposes to draw up specifications for every overhead fitting used in tramway work, including trolley wires and wheels. The Committee intends collaborating with the American Tramways Standardisation Department and with the British Engineering Standards Committee, and should provide a working model for the arrangement now suggested for dealing with electric supply fittings.

The enclosed cut-out standardised by the American National Electric Code is completely standardised as regards dimensions, and its use is practically obligatory in America. The manufacture of "N.E.C." enclosed cut-outs has consequently become a very important industry, engaging the attention of a number of specialist firms. The general use of open and protected type cut-outs, as in this country, has been impossible in America. As, in spite of this, the fire hazard in this connection is not any greater with us than in the States, it cannot be said that the universal use of the relatively expensive enclosed type is justified. Nevertheless, there is a considerable field for enclosed cut-outs to meet severe conditions, and a British Standard for such should be set up as well as for the protected type. Open-type cut-outs should be prohibited.

The short-circuit test called for in the "N.E.C." enclosed cut-out is one of 10,000 amperes, independently of the size of the fuse. While this is a comparatively light test for a large cut-out (say, 400 amperes working current), it is a severe one for small currents (10 or 30 amperes), and one which many protected-type cut-outs will not pass. For very many purposes, however, such a severe test is quite unnecessary.

It has been generally agreed that the severity of a short-circuit test to which a cut-out is subjected may be measured by the value of the short-circuit current which would flow if the fuse were replaced by a heavy copper connection having no appreciable resistance, the electromotive force of the supply remaining constant.

The various methods adopted by the standardising authorities of the different countries for determining the rating (as regards short-circuit capacity) all go on the same lines, that

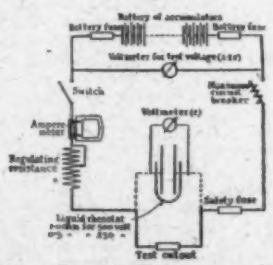

Fig. 8.—Standard Cut-out Test of the Swiss Electrotechnical Society.

is to say, the cut-out is short-circuited across a sufficiently large source of power with the short-circuit current limited to certain values.

Fig. 8 illustrates the test specified by the Association Suisse des Electriciens for enclosed cut-outs up to 60 amperes working current. The battery must have a voltage measured on open circuit at least 10 per cent. larger than the voltage of the cut-out being tested. The liquid rheostat of the value stated in the figure is first connected across the terminals of the cut-out (the latter not being in circuit), and the adjustable resistance arranged so that for a 250-volt cut-out a current of 500 amperes flows. It will be seen that this allows for a 10 per cent. drop at 500 amperes across the adjustable resistance, which corresponds to a short-circuit current of 5,000 amperes. The test fuse is then connected instead of the liquid rheostat, and must rupture the circuit without an explosion or sustaining the arc.

In Table II the various figures for the different countries are tabulated.

TABLE II.—Values of Short-Circuit Current specified by various National Rules for the Testing of Cut-outs.

Working current of cut-out.	Swiss.	German.	American (N.E.C.).	Schwartz and James.
Amps.	Amps.	Amps.	Amps.	Amps.
10	5,000	4,000	10,000	990
30	5,000	6,000	10,000	1,980
60	5,000	12,000	10,000	3,960
100	—	20,000	10,000	6,600

It is necessary to specify the minimum of plant that shall be used. It is suggested that 100 kw. would be sufficient for ordinary duty cut-outs, and 500 kw. for heavy duty ones. More may be necessary in order to reach the short-circuit capacity when testing the larger sizes of cut-outs.

The time taken to blow a fuse depends upon its size and the degree of overload.

Schwartz and James suggested the following definition of "normal fusing current":—

"The minimum current required to fuse the wire in such a time interval as shall be necessary for the wire to have attained its maximum steady temperature."

This is practically the same definition as has been adopted by the National Electric Code.

If a definite and fixed time element were specified it would be necessary to specify a different value of time element for each diameter of fuse wire; secondly, it would be necessary to have different values of time element for open, protected, and enclosed cut-outs, and likewise different time elements for each fuse metal.

A current just below the normal fusing current could flow indefinitely, and whether the conductor will reach a dangerous temperature will depend upon its heat dissipating capacity.

The Institution Wiring Rule No. 98 *b* requires that fuses "must be so proportioned to the current to be carried that no conductor protected by them can be raised in temperature above that specified in Rule 44."

It would be very desirable if directions could be issued to guide the user in applying this rule. As it stands, the requirement simply begs the question. At any rate, to specify the time element of a cut-out does not serve any useful purpose, and it is suggested it should not be done.

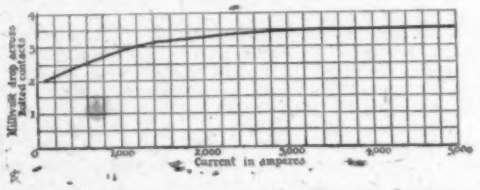

Fig. 9.—Millivolt Drop Across Bolted Contacts.

For the construction of starters and regulators the copper-nickel alloys have stood the test of time, and should be standardised. The use of iron wire should be prohibited, as well as any alloy containing zinc. At the present moment many wire manufacturers make the same wire, but call it by different trade names. This leads to confusion, and is very undesirable. It should be quite possible now to fix upon a series of standard copper-nickel alloys, naming them, for example, British Standard Copper-Nickel Nos. 1, 2, 3, &c., which should cover all usual requirements. Tables of their resistances, temperature coefficients, &c., should be issued.

The most urgent matter in connection with motor starters requiring standardisation is that of rating. Closely connected, of course, with the standardisation of rating is the question of the performance of the device under standard test conditions.

A specification of temperature rise and freedom from permanent injury to the device should be laid down.

Diversity exists at present among the different manufacturers as regards their horse-power minute ratings of liquid starters and controllers. This would be obviated in future if a standard rating could be fixed. This is only a matter of definition, and could be settled immediately if attention were given to the matter by the competent authority.

It would be a great advantage if the cross-sections of strips to be used for making the connections on switchboards were standardised. Hard-drawn copper is sometimes specified for these. Hard-drawn copper, according to E.S.C. Report No. 7, has a specific resistance 2 per cent. higher than annealed

high-conductivity copper. Its use, moreover, is wasteful, as it has to be purchased in straight, comparatively short, lengths. Thus it has to be cut to waste much more than copper purchased in long rolls. Moreover, built-up hard-drawn bus-bars must contain many more joints which are expensive to make, and also the cause of ohmic loss. In view of these facts it would be desirable to standardise on the basis of annealed copper. All strips, except the smallest, should, as far as possible, be of a uniform thickness (say ¼ in.), but of varying widths. The use of such thin strips permits of large bars being built up with maximum ventilation; moreover, they are very much easier to handle than thicker strips.

The measurement of the temperature rise of connections should be by thermometer. Connections in the immediate neighbourhood of instrument shunts should be allowed to run hotter than the normal, as such shunts dissipate their heat to a great extent through the connections. Temperature measurements should therefore not be required to be made within 1 ft. or 1½ ft. of the shunts measured lineally along the conductor. Reasonable values would be up to 500 amperes, not to exceed 20 deg. C. rise; 500 up to 1,500 amperes, 30 deg. C.; and 1,500 amperes and above, 40 deg. C. A standard of millivolt drop for bolted and riveted connections would be very desirable, and as a contribution to fixing this the curve in fig. 9 is given showing results obtainable by reasonably good workmanship.

The only British standards (apart from some minor requirements in the Institution Wiring Rules) as regards switchboard construction which have been as yet established are contained in the official regulations issued by the Home Office and Board of Trade. These are, however, concerned primarily with the safety of the workmen and of the public, and while their constructional requirements are excellent in themselves, they are not appropriate means for setting up such standards. These should form the subject of special specifications to be issued by the Standards Committee. Among the requirements to be covered by such specifications may be enumerated the following:—

Clearances, general arrangement of apparatus and connections, prohibition of the use of inflammable material, passage ways, gates, shields, &c.

From the manufacturing point of view it would also be an excellent thing if the dimensions of slabs used in switchboard construction could be standardised. This has already been done by individual manufacturers, and, if all could be brought into line, considerable economy would be effected.

As regards high-tension boards, a code of principles should be set up which would guide central-station engineers and manufacturers in selecting the type of board most suitable for the particular service required. This matter is of particular importance in view of proposals for linking-up and bulk supplies, which are likely to be considerably extended in the future. Such linking-up is difficult and costly of realisation when the stations to be connected are equipped with differing forms of switchgear.

One of the most beneficial principles of high-tension switchgear construction is the cellular principle originally enunciated by Dr. Ferranti. In the author's opinion all high-tension boards should be based upon this fundamental idea. Modern experience has shown that the cells containing the oil switches should be practically gas-tight, and the effect of arcs which have been set up as the result of accidents has demonstrated the necessity of very substantial construction of the dividing walls and partitions.

The Commission on High-tension Apparatus set up by the Swiss Elektrotechnischer Verein reported that it had been found necessary to leave openings in the oil-switch tanks to prevent their bursting when "internal explosions take place."

It is very much better to make the switch tank sufficiently strong to withstand, in conjunction with a sufficient air cushion above the oil, any pressure which may be set up due to operating conditions. Such a construction does not offer any insurmountable difficulty. If a vent to relieve pressure inside the oil switch is provided, this should communicate through a pipe with the open air or a place where the expelled fumes are harmless. The provision, however, of a drain pipe would seem to be a desirable precaution against accidents.

The horn gap, forming as it does a necessary constituent of very many forms of lightning arrester, should be standardised as regards its shape and jump-over voltage. The latter depends partly upon the diameter of the rod used in the construction of the horns, and this must therefore be specified. As regards material, both galvanised iron and copper yield good results.

Great diversity exists in present-day practice as regards the size of choking coils used for the protection of machinery against the entrance of dangerous currents. It should be possible, however, to lay down standards (expressed in millihenries) of inductance which will afford reasonable protection in the various cases. A general formula with the necessary curves for use under these conditions should not be very difficult to obtain, and their general use would prevent disputes arising.

The precise shape and arrangement of the coil should for the present be left to the different manufacturers. The minimum clear air space between the turns of the coil should, however, be fixed.

It is probable that most new transmission lines of any considerable magnitude in the near future will be protected by the aluminium electrolytic arrester.

A very considerable amount of development work in connection with the aluminium arrester has been carried out in the private research laboratories of manufacturing firms. While a good deal of the results of this work has been, with commendable broad-mindedness, published in the technical Press, naturally much is withheld and regarded as a trade secret.—In view of the importance of the matter from the point of view of the future of the British electric supply industry and of the export trade, this is unsatisfactory, as the constants of such a vital piece of apparatus should be common property, just as are, for example, the insulating properties of the commonly used dielectrics.

The question of the establishment of a national high-tension research and standardising laboratory has been touched upon. Such a question as the lightning-arrester problem could be dealt with by such an institution. In this and analogous electrical engineering developments we are not taking the leading place that we should occupy, and if this Institution could, in co-operation with the industry, take steps to alter this it would earn the gratitude of very many of its members.

Discussion at Birmingham.

Mr. F. Forbst said it was difficult to see how the standardisation of switchgear arrangements could be introduced with advantage at the present time, and especially the standardisation of complete cellular construction in connection with E.H.T. switchgear. There was, in fact, some likelihood that the E.H.T. switchgear for large bulk supply generating stations in the future would consist of a simple arrangement of duplicate lead-covered cable bus-bars and connections, very strongly clamped and supported, with oil-immersed isolating switches, and with only the oil switch totally enclosed in a separate compartment. If the author's proposals were confined to details of switchgear apparatus only, they would receive almost universal support.

Mr. R. L. Gould said that the real obstacle to complete standardisation was the existence of competition—the desire of one manufacturer to excel another. This was an axiom of healthy progress in refinement of construction and evolution of design. Standardisation was eminently desirable in matters such as the back connection studs and nuts, the length of break, the area of the contact surfaces, and other matters attending the fundamental switch function of conducting and breaking an electric current. As to a standardisation of the general style of construction which the author proposed, he thought this was a controversial subject. In the production of switchgear it was difficult to see how the standard switch would be obtained by co-operative action on the part of designers and manufacturers.

Mr. A. Krouse said that standardisation must not mean the fettering of progress; research and experiment must be excluded from the domain of standardised products, but both these must be carried out systematically with a view to ultimate standardisation. As an example of the advantage to be gained by standardisation, he referred to slate bases. These were worked by a dozen different firms, each of which made for most other trades in which slates were used, consequently, each firm had a maximum variety of requirements, with resulting inefficiency and want of precision.

Mr. G. Rogers agreed that standardisation of switchgear was urgently required; he knew of scarcely any branch of switchgear the parts of which were standard, and engineers were constantly up against trouble and needless delay in emergency through the lack of interchangeability of switchgear. The author suggested the standardisation of millivolt drop for switch contacts. The speaker was of the opinion that in each case the standard should be simply the current density of the surface contacts. There would be two standards; one for flat surfaces, and one for laminated brush contacts. In both cases the surfaces should be properly ground in. He agreed with the author that the ordinary Whitworth threads for large diameter studs were too coarse—the finer the thread, the better the contacts, and the more sensitive the action of the nuts in drawing together a number of flat surfaces, particularly when tin-foil was used between contact surfaces. Also, all nut dimensions should be standardised, so that the spanners on the job would fit every nut on the switchboard. He did not think that it was necessary to standardise the sizes of copper used in the building up of bus-bars. A much better and easier job could be made of heavy bus-bars with copper thicker than the author suggested. The details of the large number of indicating and integrating meters used on switchboards required careful consideration. Holding-down screws, and size and position of terminals, should be standardised in order that the instruments should be interchangeable.

Mr. R. G. Jakeman said, referring to Table I, it would be seen that the first four on the list were practically the same as the standard Whitworth gas thread; it would be advisable to adopt this rather than produce another standard. It was practically impossible to insulate the first coils of large induction motors sufficiently to prevent breakdown, and it was certainly the best practice to provide an external choking-coil. There was no reason why it should not remain permanently in circuit.

Mr. R. Orsettich said the discussion had shown that the views regarding standardisation were very divergent, due to the fact that the paper did not distinguish between internal and external standardisation. By internal standardisation he meant that affecting the manufacture in the works, whereas by external he meant the rules and arrangements which were made with regard to the user of the apparatus. The internal standardisation, apart from its importance to the manufacturer, affected the industry as a whole in so far as it was the basis for the production of parts or materials by firms and specialists, for instance, china insulators, copper strips, screws, carbons, &c. The external standardisation, on the other hand, greatly affected the operation, replacements, and repairs of plant. In fixing rules of this kind they must not limit future developments, but, rather, they must make room for expansion. The rules must, therefore, be mainly concerned with the drawing-up of a definite specification to enable buyers to state comprehensively all their requirements, and also to identify and compare the apparatus offered. Furthermore, they must state clearly and uniformly the tests with which the apparatus would have to comply, and the minimum conditions of acceptance. Very important amongst these were the endurance tests which had been brought forward by several standardising committees with a view of fixing the minimum time during which any apparatus had to operate satisfactorily before requiring attention or repair.

Mr. H. W. Dipple said that any standardisation of knife switches should specify for the grinding and finishing of the contact surfaces, so that the whole of the available area was used. In large C.B. telephone exchanges it was important that the resistance of the main circuits between the batteries and the point of distribution to the individual circuits should be kept as low as possible in order to avoid cross-talk; the Post Office usually specified the contact area to be not less than 1 sq. in. per 200 amperes, and the conducting parts to be not less than 1 sq. in. per 500 amperes. He had seen cases on new installations where the switches as received from the manufacturers were in such a state of adjustment that only about one-third of the available area of contact was used, consequently the switches had to be adjusted on the site. The same remarks applied also to cut-outs of the clip type with porcelain or fibre handles. He had seen such fuses received from the makers with only about one-quarter of the available contact area actually in use.

Dr. C. C. Garrard (in reply) said that several speakers appeared to think that the effect of standardisation would be to hinder progress. In his opinion the direct opposite was the case, and Mr. Krouse hit the nail on the head when he said that standardisation and research must go hand in hand. Standardisation provided a jumping-off place for new advances and improvements. It was really surprising that nowadays it should be necessary to argue for the principle of standardisation in general. Everybody who had had experience in a factory of any pretensions at all knew that works standardisation was absolutely necessary, and the national standardisation advocated in the paper only carried us a step further. He emphasised the urgent necessity of the standardisation of brass, and suggested that a committee should be set up in Birmingham working under a delegated authority from the Engineering Standards Committee to deal with this question.

THE YEAR'S PROGRESS IN THE U.S.A.

In the course of an article on the progress made in 1917, *Power* refers to the trend toward higher steam pressures. With proper selection of available equipment and close attention to air leakage it is now possible to maintain a vacuum 97 per cent. perfect, leaving little to gain. At the upper end of the thermal cycle the opportunity for improvement is greater. With present materials and designs a maximum initial temperature of 700 deg. is considered the practical limit. Made up in the proper proportions by pressure and superheat, there is a possible 10 to 12 per cent. gain in economy over present results. Increase of friction with the density of the steam, the greater expansion and contraction and other practical difficulties detract from the above theoretical estimate, but even a portion of the gain mentioned is worth striving for. Turbine builders see no insurmountable difficulties in perfecting their machines for the higher pressures. However, radical changes in boiler and valve design will be necessary. The pressure limit for the standard boiler has been placed at 350 lb., whereas 500 to 600 lb. is anticipated. Experimental work to develop boilers for these pressures is now in progress. At the present time pressures up to 250 lb. are common, and during the last year a number of installations were made or planned in which the pressures will be higher.

At Joliet, the Public Service Co. of Northern Illinois has cross-drum boilers designed for 350 lb. pressure and 225 deg. of superheat. This is the highest pressure used in a central-station plant in the U.S.A., and it is generally conceded that it is about the limit for boilers of the present standard design. In the same plant an innovation is the use of a horizontal all-steel individual economiser placed above and integral with the boiler, the whole being enclosed by a steel casing. Although careful tests have not been made as yet, the boilers have been in operation long enough to indicate that they will develop exceptionally high capacities and that the efficiency may exceed 80 per cent.

The new steam station of the Buffalo General Electric Co. is designed for 275 lb. pressure and 275 deg. of superheat, giving a total steam temperature of 689 deg. The station was planned for a capacity of 200,000 kw., but the initial installation was 60,000 kw. in three units. The boilers are of the cross-drum type, having 11,400 sq. ft. of steam-making surface each. They are fired at both ends by two 15-retort underfeed stokers. This duplex stoker setting, measuring at the grate level nearly 24 ft. wide by 17½ ft. deep, is the largest ever built, and the ratio of grate area to heating surface, 1 to 27.3, is probably the most liberal employed in power-plant practice. At normal rating a trifle less than two tons of coal per hour is fed to each boiler. The stokers are capable of supplying 15 tons per boiler per hour, and when feeding 10½ tons per hour per boiler, which is well within easy operation, the rate of combustion is about 50 lb. per sq. ft. of grate, and the evaporation per sq. ft. of heating surface is 14.4 lb. When this is compared to 3 lb., which is considered a fair figure for normal operation, it is evident the plant has been designed to carry overloads that would have been considered impossible a few years ago. To avoid difficulties with scale the make-up water is distilled.

Last year a list was given of large turbines on order. Some of these were the 50,000-k.v.a. turbo-generator for Connors Creek, the 60,000-kw. three-cylinder unit for the Interborough, a 45,000-kw. turbine for the Narragansett Electric Lighting Co., of Providence, and five 30,000- and 35,000-kw. machines for the Commonwealth-Edison Co. To this list may be added a 45,000-kw. two-cylinder compound unit and a 70,000-kw. three-cylinder machine, the largest ever made, for the Duquesne Light Co., of Pittsburgh. Some of these machines have been installed, and the others are still in the making.

In the impulse turbine there is a noticeable tendency toward symmetrical cone-shaped construction, the elimination of angles, and the production of a straight path for the steam. The early stages are becoming smaller in diameter and fewer to minimise the friction and leakage, which increase with the density and pressure of the steam, and better metals are being employed so that a high velocity of the blading may be maintained. The numerous control valves regulating the quantity of steam to the turbine have been replaced by a single throttle valve that for loads below normal lowers the pressure. This reduces the density of the steam and lessens the aforementioned losses without diminishing the heat content per pound. At the low end the stages are increasing in diameter to reduce the leaving loss to a minimum. In many of the late machines the length from the first to the last stage is less than the short diameter of the exhaust opening.

In the smaller units the turbine is rapidly replacing the reciprocating engine, even invading the small office-building plant. It requires comparatively small space and little attendance. There is no oil in the exhaust steam, and reduction gearing permits economical speeds for both the prime mover and the driven machine. The small turbine for auxiliary drive has been perfected and its economy improved. To make a combined pump or blower unit with less cost, weight, and dimensions, a one-bearing turbine has been brought forth. It is incomplete in itself, but becomes an integral part of the over-all equipment.

To take advantage of the low steam rates of the large turbines, the trend toward electrically-driven auxiliaries has continued, steam drives, principally turbines, being maintained in lesser number to ensure continuity of service and to maintain a proper heat balance.

Manufacturers report orders for geared units as opposed to the direct-connected turbine in the ratio of three to one. In operation the gears are standing up well, and have been perfected to such a point that they make little noise. Large geared units for excitation are being built up to 1,000 kw. In these designs the turbine may operate at its most economical speed, and the generator at the low speed necessary to ensure perfect commutation.

Surface condensers are naturally following the turbine and getting larger each year. Up to date 70,000 sq. ft. of active tube surface in a single shell is the largest. Condensing equipments for the 60,000- to 70,000-kw. turbines for the Interborough and Duquesne Light Co. plants are to contain 100,000 sq. ft. of surface, but it is to be disposed in four shells. Among large jet condensers the installation at Providence serving a 45,000-kw. turbine still holds the record.

A boiler unit commensurate in size with the larger turbines has been developed. It is known as the Stevens-Pratt boiler, and is made up in four sections, each being a complete Babcock & Wilcox cross-drum boiler in itself, with its own superheater, economiser, and forced- and induced-draught fans. There are two sections on either side, the boilers being placed back to back. One stack serves the unit, and the coal- and ash-handling equipment is common to the two sections on the same side of the unit. If desired, any one or more of the sections may be operated independently. The sections are made in sizes ranging from 5,000 to 14,500 sq. ft. of heating surface. Four of the largest sections operating at 400 per cent. of rating will carry 58,000 kw. The unit occupies 7,632 sq. ft. of floor space. It avoids an elaborate boiler room

building, as, with the exception of the coal bunkers, the unit is complete in itself.

During the year 25-cycle rotary converters up to 6,825-KW. capacity have been put in operation, and 60-cycle machines up to 5,800 KW. in size have been installed. These machines are the largest of either type that have so far been built.

The most interesting transformer unit of the year is probably the 44,000-volt to 6,000-volt, 8,000-K.V.A. oil-insulated self-cooled unit, six of which were built for the Carnegie Steel Co. The radiators are constructed of a number of vertical flattened tubes welded into headers, which are flanged and bolted to the tank. The 24 radiators on each tank give an effective cooling surface of approximately 1,000,000 sq. in. Oil-insulated water-cooled units of over three times the foregoing capacity are under construction or being installed.

The Pacific Light & Power Co. has installed in its Eagle Rock sub-station at the end of a transmission line 241 miles long, a 15,000-K.V.A. synchronous condenser. This is used to maintain constant voltage at the receiving end of this long transmission line, which is operated at 135,000 volts with grounded neutral at the power-house end. Before the condenser was installed, the no-load voltage at the receiving end was 211,000 volts. With the condenser in service the voltage at the receiving end of the transmission line is held practically constant under all conditions of load.

In the steel industry the application of electricity has continued to make rapid advances. There is in use at the present time approximately 690,000 H.P. on main-roll drives in the United States, an increase of 400 per cent. during the last five years. These drives require very large motors. A reversing blooming-mill unit is one of the largest direct-current single-unit motors that has so far been built. It has a momentary rating of 10,000 H.P. at 40 R.P.M. The machine is fully compensated, and is shunt-wound. In spite of its great size, it can be accelerated at the rate of 50 revolutions per second. The motor is supplied with power from a flywheel motor-generator set, consisting of a 2,000-KW., 500-volt generator, driven by a 2,200-volt, 2,000-H.P. induction motor. The flywheel weighs 100,000 lb.

The vast increase in the use of electrical furnaces is evidenced by the fact that in the U.S.A., January 1st, 1916, there were 36 furnaces in use, having a capacity of 191 net tons, and requiring 90,000 K.V.A. At the present time the capacity has increased to approximately 1,000 net tons, requiring about 230,000 K.V.A.

A 250,000-KW. totalising graphic meter built for the Keokuk plant of the Mississippi River Power Co. is the largest meter ever constructed. The instrument will give a graphic record of the output of the 30 3-phase, 7,500-KW. generators to be installed ultimately in this plant. To accomplish this, 30 polyphase-meter elements, each made up of two single-phase units, are used. The induction type of meter element is employed. The moving element consists of six aluminium vanes, all supported on a single shaft. All connections are carried to the top of the instrument to a circular terminal board having 240 binding posts. The chart is 12½ in. wide, and is printed in 12-hour sections, and feeds at the rate of 3 in. per hour.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

2,860. "Magnetic compasses." H. O. Merriman. February 18th.

2,863. "Signalling lamps." E. W. Lovely. February 18th.

2,877. "Electrolytic gas process." D. Macdonald & R. F. Macdonald. February 19th.

2,878. "Carbonisation and distillation of coal, &c., by electricity." L. Moorhouse & C. W. Simpson. February 19th.

2,886. "Method of producing electricity and mechanical power by permanent magnets." D. Suchostawer. February 19th.

2,912. "Electrically-operated friction clutches." M. Walker. February 19th.

2,953. "Electric gas-lighters." J. W. Mackenzie (Safety Gas Lighter Corporation, U.S.A.). February 19th.

2,970. "Electric steel manufacture." V. Stobie. February 20th.

2,985. "Dynamo-electric machines." D. Swift & P. Churchill. February 20th.

3,005. "Morse-code recorder." E. Fox. February 20th.

3,008. "Trolley heads for electric traction." W. Pickersgill & J. H. Gill. February 20th.

3,013. "Enclosed electric bells." British Agencies, Ltd., & J. B. Eder. February 20th.

3,014. "Mine, &c., electric bells." British Agencies, Ltd., & J. B. Eder. February 20th.

3,016. "Travelling apparatus controlled by electric waves for deposit of mines, for attack, for supply of munitions, &c." G. de Yrarrazaval. February 20th.

3,022. "Electric resistances." British Thomson-Houston Co. (General Electric Co., U.S.A.) February 20th.

3,023. "Electrically-controlled window raising and lowering mechanism." F. W. Howorth (Perfect Window Regulator Co., U.S.A.). February 20th.

3,056. "Dynamo-electric machinery." F. Creedy. February 20th.

3,059. "Electromagnetic apparatus for detection of large masses of iron or steel." A. H. Booth. February 21st.

3,070. "Electric resistance furnaces, and heaters and resistances, &c." F. Rogers. February 21st.

3,105. "Methods of manufacturing cylindrical magnet frames, &c." British Thomson-Houston Co. (General Electric Co., U.S.A.) February 21st.

3,106. "Electric relays." E. Fawssett & H. Parry. February 21st.

3,107. "Rotary electric switches." T. Ammann. February 21st. (Germany, February 21st, 1917.)

3,140. "Audion or lamp relay or amplifying apparatus." M. Latour. February 21st. (France, April 15th, 1916.)

3,159. "Device for detecting demagnetisation." W. A. Clark, H. G. Longford, W. W. Longford & Sphinx Manufacturing Co. February 22nd.

3,185. "Electromagnets." Soc. Anon. des Etablissements L. Bleriot. February 22nd. (France, November 7th, 1917.)

3,186. "Voltage-controlling mechanism for electric installations." Soc. Anon. des Etablissements L. Bleriot. February 22nd. (France, November 8th, 1917.)

3,188. "Controlling mechanism for use in electrical installations." Soc. Anon. des Etablissements L. Bleriot. February 22nd." (France, November 7th, 1917.)

3,195/3,196. "Magneto-electric machines." British Thomson-Houston Co. and H. K. Trenchmann. February 22nd.

3,213. "Electric heating apparatus." Naamlooze Vennootschap. Fabriek van Instrumenten. en Electrische Apparaten Inventum. February 22nd. (Holland, February 23rd, 1917.)

3,237. "Electric controllers of the barrel or drum type." W. G. Pipkin and Veritys, Ltd. February 23rd.

3,244. "Means for detecting small electric currents." J. S. E. Townsend. February 23rd.

3,267. "Cord connections." Naamlooze Vennootschap Fabriek van Instrumenten en Electrische Apparaten Inventum. February 22nd. (Holland, February 23rd, 1917.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

15,366. Electric Accumulators. H. Leitner & W. H. Exley. October 27th, 1916. (112,956.)

18,672. Apparatus for Transforming, and especially for Rectifying, Alternating or Polyphase Currents. J. F. G. P. Hartmann. December 30th, 1915. (102,977.)

1917.

1,501. Means and Apparatus for Storing and Correcting Defective Telegraphic Signals Preparatory to Transmission. Eastern Telegraph Co. and J. H. Dunbar. January 30th, 1917. (112,978.)

1,544. Dynamo-electric Machines. Soc. Anon. Pour l'Eclairage Electrique des Vehicules. February 4th, 1916. (104,172.)

1,641. Electromagnetic Switches. British Thomson-Houston Co. (General Electric Co., U.S.A.) February 1st, 1917. (112,983.)

1,653. Electric Transmission of Signals. E. A. Laidlaw. February 1st, 1917. (112,985.)

1,713. Electrical Measuring Instruments. J. H. Care. February 2nd, 1917. (112,990.)

1,851. Electromagnetic Switches. British Thomson-Houston Co. (General Electric Co., U.S.A.) February 6th, 1917. (112,996.)

1,953. Electromagnetic Switches. British Thomson-Houston Co. (General Electric Co., U.S.A.) February 8th, 1917. (113,001.)

2,133. Device for Supporting the Shades or Reflectors upon Incandescent Lampholders and for Locking the Lamp to its Holder. W. Waller. February 13th, 1917. (113,007.)

3,363. Controlling Device for Electrically- or other Power-driven Air Compressors for Raising Water. P. Frank & Kynoch, Ltd. March 7th, 1917. (113,022.)

5,451. Protective Devices for Dynamo-electric Machines. British Thomson-Houston Co. (General Electric Co., U.S.A.) April 18th, 1917. (113,037.)

7,702. Dynamo-electric Machines. Soc. de Paris et du Rhone. May 29th, 1916. (107,010.)

8,631. Magnetic Pulleys and Belting. P. L. Weston. January 8th, 1917. (112,612.)

10,709. Prismatic Glassware for Illuminating Purposes. Holophane, Ltd. (Holophane Glass Co., U.S.A.) July 25th, 1917. (113,063.)

14,738. Portable Electric Transformers. Johnson & Phillips and W. C. Kennett. October 11th, 1917. (113,077.)

Electrical Developments in Austria.—The *Board of Trade Journal*, quoting from the *Wiener Zeitung*, *Wiener Abendpost*, says:—"In introducing in the Reichsrat the Austrian Government's Bill for the promotion of electrical development, the Minister of Public Works emphasised the backwardness of Austria in regard to electricity. Estimates of the available water-power, he said, varied between 1,700,000 and 5,000,000 H.P. If 4,000,000 H.P. could be used, the saving in coal would amount to 22,500,000 tons per year, or about 50 per cent. of the normal consumption; Austria could then export coal to Germany, instead of having to import it from that country. Among special features of the Bill may be noticed the provision that the State will participate in the profits of undertakings to which any State privileges or concessions have been granted, when the profits exceed 6 per cent., and the provision that the State will have the right to acquire undertakings after 25 years, and at the end of every subsequent period of five years."

Power Plant Farthest North.—A 45-KW. hydro-electric plant for light and power in the town of Chitina, Alaska, has just been put into operation. It was built by the owners, O. W. and M. S. Nelson, has been under construction for two years, and cost $22,000, making it probably the most costly plant per kilowatt in the world. One of its distinctive features is that it is the farthest north of any year-round hydro-electric plant on the continent. The water-power is drawn from a three-acre lake situated 100 ft. above the Copper River and separated from it by a ridge. By driving a 1,400-ft. tunnel through this ridge, the water from the lake is carried over to the Copper River side, where it is dropped down 100 ft. through 270 ft. of 16-in. steel pipe. The tunnel was driven through 900 ft. of frozen earth and loose rock and through 500 ft. of extremely hard solid rock. The earth and rock were thawed with steam jets.—*Journal of Electricity.*